ELECTRICAL REVIEW

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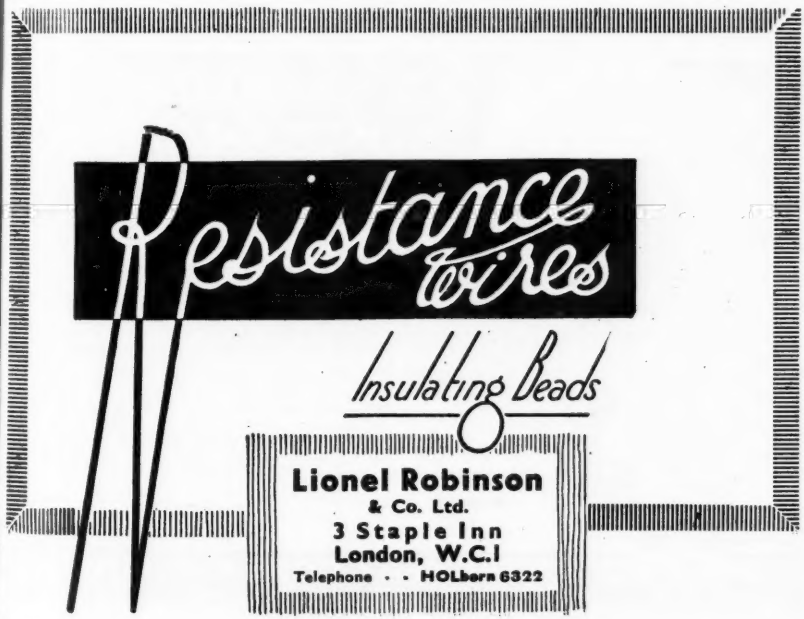

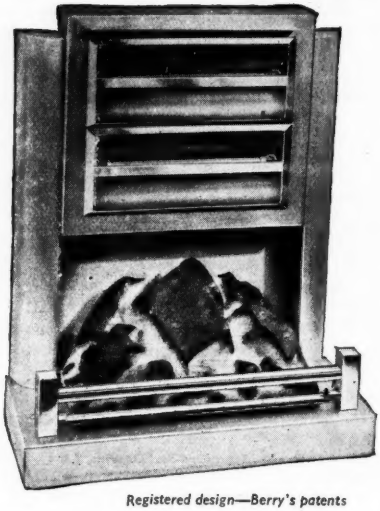

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ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXVII. No. 3550. DECEMBER 7, 1945 9d. WEEKLY

Government as Producers

Implications of the Building Materials Bill

THERE are at least three possible ways of achieving nationalisation of industry. Compensation may be paid to the proprietors; the business may be confiscated without compensation; or the owners may be squeezed out by Government competition. The first method may be grudgingly accepted as fair but the second is deservedly condemned by all right-thinking people. As to the third, opinions may differ but we think that the right-thinking people will consider it almost as bad. It represents merely the difference between a sudden end and a lingering death.

In its proposals for nationalising some of the country's public services, the Government has quite definitely decided in favour of fair compensation, but there are indications that it will not hesitate to compete with heavily-loaded dice against, producers and distributors of building materials and equipment.

"In a Big Way"

In moving the second reading of the Building Materials and Housing Bill last week, Mr. Tomlinson (Ministry of Works) announced the Government's intention of manufacturing and distributing building materials and components "in a big way." In this connection we have already reported a statement by the Director-General of Housing Supplies that twenty Royal Ordnance Factories are going to be turned over to the production of materials and equipment, including electrical appliances.

We are of the opinion that there is already sufficient actual and potential manufacturing capacity in this country to meet the demands for electrical equipment for new houses. This is largely hamstrung at present by lack of technical staff and factory labour which exists but is retained in the Forces or on other work. No doubt a Government undertaking could easily surmount this handicap, regardless of the inequity of the matter.

Conversion or Reconversion?

But apart from inequity, is it wise to divert labour from the established manufacturers to Government factories? During the war electrical appliance makers have had to go over to the production of military supplies and they are now in process of reconverting their works. For this they have the requisite knowledge and experience and at least some of their pre-war plant. On the other hand the conversion of a factory designed purely for the production of munitions is likely to prove a much more difficult and lengthy process.

In the debate on the Bill Mr. David Eccles made a good point when he said that if speed of delivery were the object, experience showed that it was better to use existing capacity to the full, unless it was hopelessly out of date, than to create new productive capacity. If industry knew the target it might be able to promise delivery and there would be no need to create this new capacity. Mr. A. C. Bossom said that the converted Royal Ordnance Factories could not possibly reach peak production for a year or a year and a half. Why not use existing factories and save a year? The electrical industry

will echo this question and ask for a square deal. The welfare of the industry is not the main thing, however. What is wanted is the best service to the public, but we consider that this is another case of "enlightened self-interest" as the two objects are in agreement. On the Committee stage the period of operation of the fund set up by the Bill was extended from 1947 to 1950. An unsuccessful attempt was made by Mr. Willink to secure that the Ministry of Works would not embark upon the production or distribution of equipment unless the existing organisation proved inadequate.

Reversed Refrigeration

IT is now nearly a century since Kelvin first suggested that a compression refrigerator operating on a reversed cycle could be used to provide space heating. Little has been done towards applying the principle in this the country of its origin, no doubt because high capital charges would have been more than enough to offset very low running costs unless the plant were required for air-conditioning in the summer as well. However, the present high prices of coal warrant a re-examination of the economics of the system, as a new E.R.A. Report (reviewed elsewhere in this issue) intimates. The heat pump recently installed at Norwich should provide valuable data regarding the suitability of the system for conditions in this country.

Nationalisation Doubts

IN our leader of November 30th we suggested that it was not only the company undertakings which viewed electricity supply nationalisation with concern; some of the municipalities were no happier about it. A week or two ago at a meeting of the Edinburgh Town Council a motion was put forward expressing concern at Mr. Morrison's statement that gas, electricity and transport undertakings were to be nationalised. The voting was 39 in favour and 20 against but as a three-quarters majority of those present was necessary to secure its adoption the motion failed.

Mathematics and Industry

MUCH time may be spent in working out formulæ involving a number of variables by research workers who may not have the special aptitude required or are out of practice. Often the effort involved would be better transferred to calculating machines, which have been developed considerably in recent years but are not generally ready to hand. The setting up by the Department of Scientific and Industrial Research of a Mathematics Division, equipped with mechanical computing devices, under Mr. J. R. Womersley, in the National Physical Laboratory should meet a real need. The Division is in three sections, dealing with computing, statistics and the development of calculating machines, and it is also available for consultation in regard to applied mathematics, with particular reference to industrial research.

Electrical Safety

IN his report for 1944 (referred to on a later page) Sir Wilfrid Garrett, Chief Inspector of Factories, shows that the decline in the number of electrical accidents in factories (mentioned in the *Electrical Review* of September 7th) is part of a general improvement of the accident rate from all causes over previous records of the war years. It also places electrical risks in their true perspective since, although it increasingly permeates all workshop processes, electricity was responsible for only 0·39 per cent. of the total number of reportable accidents and 3 per cent. of the fatalities whatever their cause. Many of the accidents due to electricity were, however, preventable and their small proportion is no argument against taking necessary steps to reduce their possibility.

Combustion Limits

NOT the least of the contributions made by electricity to national welfare has been the provision of a market for low-grade fuel for which there is little alternative use. Complaints during recent years about the quality of coal supplied to power stations have mostly referred to its unsuitability for individual combustion conditions, especially when its characteristics, good or bad, have fluctuated widely and rapidly. While boiler plant can, no doubt, be designed to burn any type of fuel with a fairly wide margin for reasonable variations from the normal, that is not to suggest that the same furnaces and associated auxiliaries should be required to cope with coal of any calorific value or volatile and ash content.

Steel Making

A Modern Installation of Arc Furnaces

BY the courtesy of the Brymbo Steel Co., Ltd., we were recently able to obtain some impressions of the processes employed in steel making by means of modern electrode furnaces at its works at Brymbo, N. Wales. Three Siemens 15-ton and one E.F.Co. 5-ton furnaces are arranged in line down the smelting shop which is about 62 ft. wide and 540 ft. long. Adjacent to this shop is a large scrap bay with bins in which scrap steel is loaded from railway wagons by crane-suspended magnets. From the bins the scrap is, as required, loaded into the furnace charging basket which is carried on a special bogie for convenient transport to and from the smelting shop and scrap bay. The bogie is driven by its own motor which is supplied by a trailing cable. This is carried round a spring-operated drum to keep the cable taut at any position of the bogie.

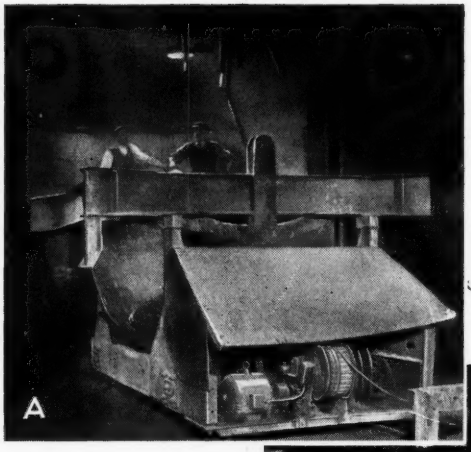
In the smelting shop the basket is hooked to a beam suspended from the crane hook, and chains from the beam to the door at the bottom of the basket hang slack during transport to the furnace to be charged. The shell or furnace container is first drawn from the main furnace structure in readiness to receive the charging basket, and for this purpose the shell and the operating platform as one unit runs on wheels and is motor driven. The operating platform slides under the fixed platform which constitutes the normal shop floor.

The title photograph shows one of three 15-ton arc furnaces which are arranged in line down the smelting shop

When the basket is lowered on to the furnace shell the frame at the top of the basket rests on the top of the shell and the basket proper is actually inserted in the shell. The basket is then unhooked from the beam and the upward pull on the chains opens the basket doors, rather like a jaw grab, and the scrap falls into the shell.

Each of the large furnaces is constructed so that the roof lifts and the shell travels out for recharging. The roof is suspended by four chains from two shafts which are motor driven *via* a train of gears. For tapping (pouring the molten metal) the whole furnace structure tilts on rockers under the operation of a motor which, *via* reducing gear, drives pinions which engage with a pair of racks projecting downwards from the furnace body, thereby raising or lowering the back of the furnace as this rides on its rockers.

The three 2¼-HP DC electrode-operating motors are vertically disposed on the electrode and furnace-top supporting structure at the supply side of the furnace, and each transmits to the counterweighted electrode arms through reducing gear and a system of ropes and pulleys. On the other side of the furnace structure is mounted the motor for raising and lowering the furnace roof. All the main furnace operations are electrically interlocked. For instance, the electrodes must be up before the roof can be raised, and the roof must be raised before the shell can be driven out for charging. The graphite electrodes, each 14 inches in diameter, are



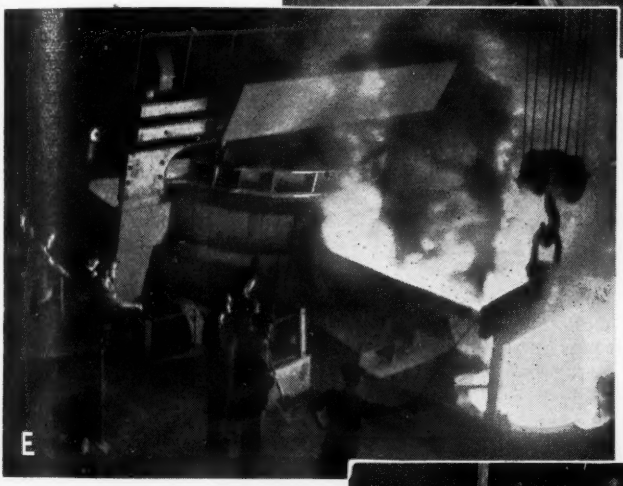
gripped by shoes to which are bolted very heavy copper connection bars, and from the feeding ends of these bars heavy multiple flexible cables are directly connected to the furnace transformer—an English Electric 7,500-kVA, 6·6-kV (primary). The secondary has a range of voltage tappings from 240 to 92. During normal melting operations the electrodes carry a current of 16,000 A at 240 V.

The furnace is switched on and off by an English Electric air-blast circuit breaker on the primary (6·6 kV) side of the transformer. An air compressor and main receiver automatically maintain an air pressure between 150 and 200 lb. per sq. in. and feed a local air receiver (100 lb. per sq. in) through a reducing valve on the circuit-breaker proper. The power to open and close the breaker is supplied by the air in the local receiver, under the control of small electrical relays operating on small air valves. The air pressure in the local receiver is also used to extinguish the arc when the breaker is tripped. These circuit-breakers are designed for very heavy service.

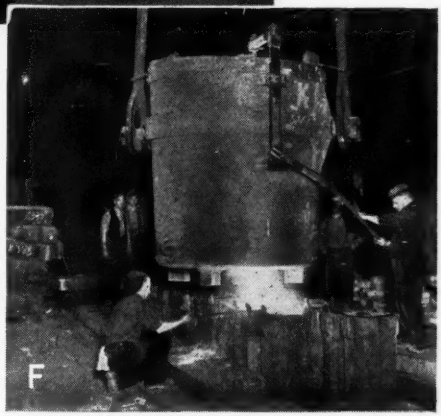
Direct operation of the electrodes may be effected

The above illustrations depict the main operations in steel making by modern electrode furnaces as seen at the Brymbo Steel Works. Scrap metal is first magnetfed into the furnace loading basket on a transit bogie (A). The furnace shell is drawn out away from the . . . .

by drum controllers which can be actuated at will by hand, but during normal furnace working the electrodes are automatically operated under the influence of a balanced power relay. This works on the moving-coil principle and has one current coil and one voltage coil on the magnetising circuit, and one moving coil. The voltage coil is connected between the electrode and the bath, *via* a metal rectifier in series with the voltage resistances, and the current coil is connected across a current transformer through a metal rectifier. Thus any out-of-balance of voltage and current is immediately detected by the relay which brings in either the raise or the lower electrode contactor.



The automatic control equipment of each furnace was supplied by the Watford Electric and Manufacturing Co., Ltd. The panels are housed in a separate room near the furnace. The main control panel provides for the operation of the air-blast circuit breaker and houses push-button switches for selecting the working voltage tappings on the secondary side



. . . . raised top, leaving the electrode ends exposed (B) and the basket is lowered into the shell for charging (C). For tapping, the complete furnace is tilted by means of racks at the back (D) and the metal is poured into the ladle in the pit on the other side (E). Finally the ladle is brought, in turn, to the correct position for teaming (F) over each of the ingot moulds.

of the furnace transformer. The actual furnace controls are housed in and on an adjacent control desk, and these include drum controllers for the electrodes, a selector switch, a smoothing control switch, push button control of the furnace roof, and a load adjusting regulator. The drum controllers govern the electrode motors and have seven positions—raise fast, raise, off, auto, off, lower, lower fast. In the automatic position the motors are under the control of the regulators. The selector switch has three positions, " starting " (hand or auto) " hand " (off load), " running " (hand or auto).

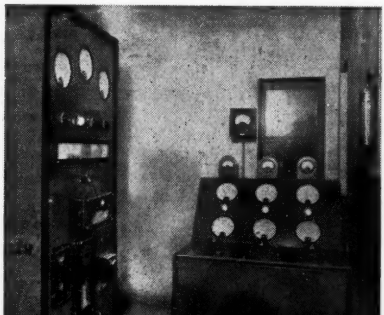
In the " starting " or " running " positions the electrodes can be under the control of the regulator or the operator. In the " starting " position the electrodes automatically stop upon touching the charge and remain stationary until current flows from electrode to electrode, whereupon they draw away until the correct arc is formed. In the " running " position the electrodes immediately draw away on touching any of the charge until the correct arc is formed. The smoothing control switch has two positions, " on " and " off," and when in the " on " position the electrodes run at a reduced speed.

The load adjusting regulator has eight positions, and the current which flows through each of the three electrodes can be increased or reduced by the turning of one handle. This is accomplished by selecting different tappings on a tapped transformer and altering the ratio between the main current transformers and the current coil on the balance power relay.

In preparation for tapping, the ladle refractory lining is first heated by an oil and air jet flame. An overhead crane lifts, transports and lowers the ladle into the pit below the furnace spout. The furnace is then tipped as described, the crane all the while lowering and keeping the ladle in the correct position to receive the molten metal.

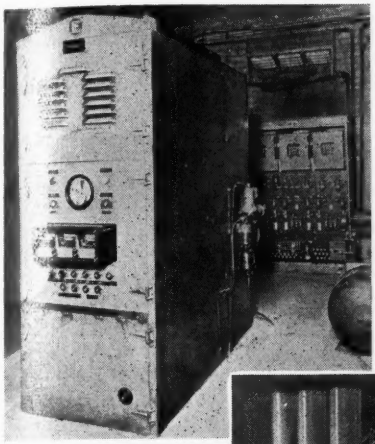
When all the steel has been poured from the furnace the ladle is lifted from the pit and transported down the shop to the moulds which are waiting to receive the molten metal. The ladle is brought, in turn, into the correct position for teaming over each vertically disposed mould, and the metal runs through a " valve " in the bottom of the ladle. This consists of an aperture in a brick housing, with a seat in which rests a brick and iron rod which extends up inside the ladle, over the top and down the outside to a point where there is suitable lever operating mechanism.

There are three Anderson-Grice 25-ton cranes spanning the smelting shop, each with a 5-ton auxiliary hook, as well as a 10-ton crane on the same track at the bottom end of the shop for transporting the ingots, etc. Each of the cranes has s.r. motors for the travel, traverse and hoist motions, and the use of AC for these purposes has given very satisfactory results, largely, it is believed, because the shop working conditions do not call for very low speeds which might demand the use of DC or, say, widely variable-speed AC motors. The use of continuous-rating motors has been proved an advantage on account of the high ambient working temperatures. Each crane is also fitted with a lifting magnet which is supplied by a m.g. set aboard the crane.



A main control panel provides for operating the air-blast circuit-breaker and the transformer tappings, and the actual furnace operations are effected from a control desk

The travel, traverse, main hoist and auxiliary hoist motors on each of the large cranes are of 40, 17·5, 50 and 17·5 HP, respectively, and the travel, traverse, main hoisting and auxiliary hoisting speeds are 350, 175, 20 and 35 ft. per minute, respectively. The crane span is 62 ft. and the height from the floor to the crane rail is 28 ft. The m.g. set in each case has a capacity of 14·3 kW. All the motion motors are controlled by the usual rotor-resistance regulation and direct-on stator switching



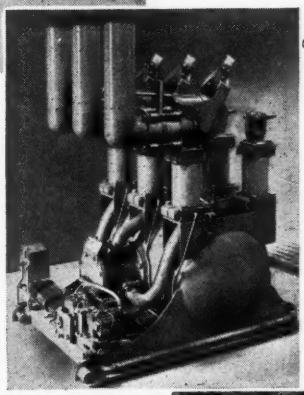
The contactors are housed in a separate cabinet at the back of the air-blast circuit breaker cabinet ; air-blast circuit breaker shown on the right

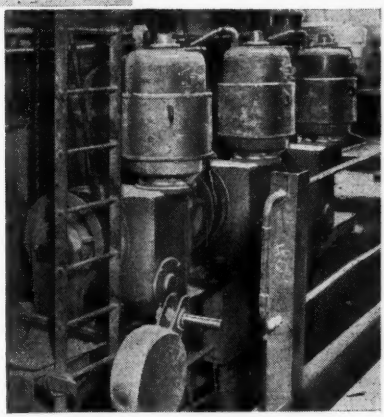
equipment, and in each case transmission is by pinion-type reducing gearing. The hoists are fitted with solenoid brakes which have shoes bearing on the brake drums. Each of the three large cranes is capable of all the duties pertaining to charging and tapping, but the usual practice to is use the bottom (mill) end crane for tapping, the centre crane for charging, and the top end crane for handling ladles and general preparation work. There are two 10-ton cranes in the scrap bay which handle the scrap metal, alloys, lime, basic, etc., and the electrical arrangements for these are similar to those of the large cranes in the smelting shop. The same applies to the smaller crane in the smelting shop.

The main electricity supply source for the furnace installation is one of the works substations where a supply is received from the North Wales Power Co. system at 33 kV at the incoming circuit-breaker of a 5-unit board with Ferguson, Pailin spring-operated metalclad switches of 500-MVA rupturing capacity. The spring closing mechanisms of the circuit-breakers are charged manually by hand, but the release is effected electrically and remotely from a suitable control board.

Two of the circuit-breakers serve two Parsons 33/6·6-kV transformers which feed on to a 6·6-kV isolator and distribution board. This is equipped with isolators which serve directly the air-blast circuit-breakers for the arc furnaces, as well as an isolator which is connected to a 250-kVA transformer (6·6 kV/400 V) for supplying the plant auxiliaries.

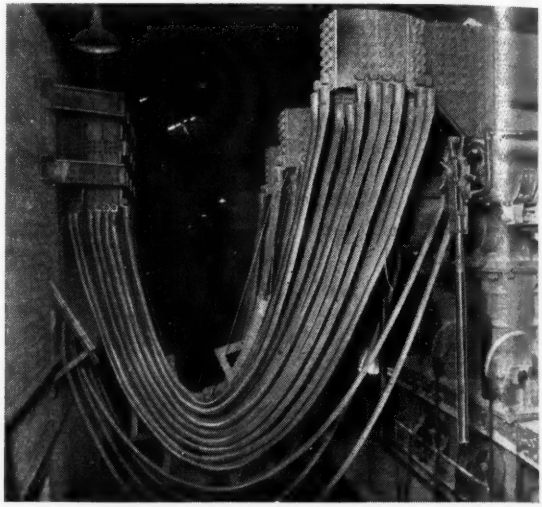
In consequence of the very heavy peak load conditions of the plant, special attention is paid to the control of maximum demand by a Watford control apparatus. This includes a main Metro-Vick instrument which has an " ideal load " pointer, travelling at a constant speed throughout each half-hour demand period, and reaching at the end of that period a predetermined maximum demand figure. A second pointer mounted concentrically with the first and driven by impulses received from the main meters travels at a rate proportional to the actual load consumption of the works. When the " actual load " pointer approaches the " ideal load " pointer an amber warning light is switched on, but if it overtakes the " ideal pointer," a red lamp is illuminated. Automatic gear operates in parallel with the above





The 2-HP vertical electrode motors transmit *via* ropes and pulleys to the electrode arms

indications, and furnaces taking more than a certain predetermined load are reduced. When the load is so reduced that the "actual pointer" lags behind the "ideal pointer" the load is increased. Thus at the end of the half-hour period the maximum demand is as near as possible to the predetermined figure. At the end of each demand period both pointers are reset, but the "ideal load" pointer is provided with a certain amount of lead, thus preventing any load reduction during the early stage and providing against unforeseen load decreases in the latter part of the demand period. The total load for every demand period is recorded on a printometer, and another instrument records the extent and time of the load reductions.



During normal operations the electrodes carry about 16,000 A, so that very heavy multiple flexible leads are required

Protection against a failure of this maximum demand control system is afforded by a safety check instrument which is set in such a way that it will trip all the melting furnaces if the load reaches a predetermined figure at any time within the first 25 minutes of any demand period. If, however, the load is below this figure at the end of 25 minutes, but reaches a slightly higher predetermined value during the remaining 5 minutes of the period, the safety check instrument will again trip all the melting furnaces.

We are indebted to the directors of the Brymbo Steel Co., Ltd., for permission to visit the works and to publish this article, and to Mr. A. T. Harris, the electrical engineer, for his help in obtaining the above information and the accompanying photographs.

Industrial Accidents

LAST year the number of persons employed in works subject to the Factories Act amounted to 6·7 million (half of them being males over eighteen years) which was 4 per cent. fewer than in 1943. There were 1,003 fatal and 281,578 non-fatal reportable accidents corresponding to reductions of 17·8 and 9·1 per cent. Power driven machinery was involved in 15·6 per cent. of the total number—a proportion that has tended to decline each year, largely due to safety organisation—and 10·2 per cent. of the fatal accidents. Electrical accidents numbered 1,072, against 1,255 in 1943.

Accidents in electrical engineering works aggregated 24 fatal and 10,237 non-fatal out of 67 and 34,145 in engineering works generally. In electrical stations there were 14 fatal and 1,647 non-fatal accidents; in gasworks the corresponding figures were 16 and 3,127. Electric accumulator works reported only three cases in the industrial diseases category, none of them fatal, compared with 15 in 1940 and 47 (two fatal) twenty years earlier.

While the value of good lighting is increasingly recognised, there are still industries in which it is regarded as a luxury rather than a necessity for production and for the well-being of the worker. Regulations requiring all concerns to conform to a reasonable standard should be possible in the near future. Ignorance regarding glare is common and instances are quoted of misplaced zeal in fuel economy that has led to unsatisfactory illumination. Lighting intensities have often been doubled by cleaning.

The annual report of the Chief Inspector of Factories (Sir Wilfrid Garrett) for 1944, from which the above data are taken, is obtainable from the Stationery Office at 1s. 6d.

Electricity in Horticulture

Many Possible Applications

By "Cincinnatus"

DEVELOPMENTS in horticultural electrification may not be so advanced or so spectacular as in agriculture but they are, none the less, useful and important. The principal applications of electricity are to soil sterilisation, soil heating, irrigation and spraying, plant irradiation, nutrient solution cultivation and space heating. The last application is limited purely by commercial considerations. For electricity to be competitive with coal-fired, water-heating systems for large greenhouses a very low tariff is necessary and electric heating generally enters as an auxiliary method. For the private greenhouse, however, electric heating has certain advantages which appeal to the amateur gardener. These are flexibility, control of temperature and convenience of use with its absence of stoking problems.

Soil sterilisation has long been used to fight disease and to promote fertility. At a certain soil temperature, organisms dangerous to plant life are destroyed and the useful bacteria are enabled to convert organic substances into plant food. The critical temperature for this purpose appears to be about 176 deg. F., although American experiments have been successfully carried out at a temperature of 158 deg. F.

Indirect and Direct Sterilisation

Two electrical methods have been used—indirect and direct heating. With the indirect or "immersion" system the heating elements are embedded in the soil and insulated from it. In the direct system the current is passed through the soil. Owing to the high heat losses entailed, indirect heating has not been applied to large-scale soil sterilising in the ground but a "box method" has been developed. American investigators put the heating elements in boxes having a top inlet and a bottom outlet for the soil after heating. The loading was about 7 kW per cu. yd. Using a critical temperature of 158 deg. F. the consumption was 1·2 kWh per cu. ft.—a figure close to those obtained by Continental investigators. British experiments made before the war showed results of 1·5 kWh per cu. ft. using a critical temperature of 176 deg. F.

Differences in results may be expected owing to the wide variety of soils encountered, for thermal conductivity is related to soil moisture content and to the consistency of the soil. This may be dry and sandy or moist with a high humus content. Initial moisture content is a most important factor in the direct or resistance method of sterilisation, for the soil is acting as a conductor and this determines the current and the time taken to reach a given temperature. Further, the soil immediately surrounding the electrodes begins to dry out, causing an appreciable increase in total resistance, so that the current may drop quickly with a consequent decrease in heating. The point at which this action occurs is critical and it has been found in practice that soils commonly used for nursery work and potting have enough moisture to allow 176 deg. F. to be attained by the bulk of the soil before this point of current and heating decline is reached.

Load and Consumption

There was a number of electric soil sterilising equipments on the market before the war, ranging from 50 lb. to 1 ton in capacity, and available for either AC or DC circuits. Consumption was given as about 1·2 kWh per cu. ft. of soil treated, this figure varying with the resistivity of the soil used. Maximum demands were given (for medium loam soils) as from 2 to 3 kW per cwt. and the time for adequate sterilisation as one hour to an hour and a half. During the war researches have been made at the Universities of Cornell and Minnesota to improve the technique of soil heating and promising results are reported from Minnesota with a new insulated sterilising apparatus having a capacity of 0·5 cu. yd. In Great Britain, conditions have been adverse to research, but the Electrical Research Association has been able to keep experimental work in being and should be able to extend development now.

Soil heating by electricity developed more rapidly on the Continent than in Great Britain since the use of hotbeds in horticulture is more extensive abroad. Sweden is reported to have some 4,000 kW of soil-heating plant in its horticultural industry. However, traditional practice is being influenced by the

general advance of electricity and the results of the simplified heating methods developed by the E.R.A. should be apparent in a much increased number of electrical installations.

The common method is to bury the cable direct in the soil or in sand below the soil as this tends to spread the heat more evenly. Since cables laid direct are liable to be damaged by the gardener's fork, it may be advisable to put an armouring over the lead sheath. In some installations the heating cable is kept separated from the soil in a compartment below the hotbed. The advantages claimed for this indirect method are that more than one type of heating element can be used and that replacement does not interfere with the seedlings in the hotbed. However, this indirect method is relatively costly and is restricted mainly to propagating boxes.

Soil heating has two chief classes of application—salad beds and nursery beds. In the first class a crop of relatively low value is raised to complete growth, ready for marketing. In the second, the bed consists of a sand basis on which seed boxes of cuttings can be warmed, the market value of the plants being relatively high. For these applications the ordinary manure hotbed has the disadvantages of the amount of labour needed to prepare the hotbeds, the lack of efficient control of the heat obtained and, notably at the present time, the difficulty of obtaining adequate supplies.

Simplified Installation

The idea has been current among market gardeners that electrical hotbeds are expensive and complicated, but this is an entirely false impression. Recent investigations have gone far to demonstrate the simplicity and economy of electric heating, applied intelligently. Even thermostatic control has been eliminated. The first major change in method has been to lay the cable (or bare wire) direct in the soil of the garden frame instead of using the customary sand bed. For the amateur gardener, a simple form of connection and supply line is run to the house. Plants, which may be lettuces and carrots, are sown early in January and the frame is undisturbed until cropping begins. A "dosage" system is substituted for thermostatic control, a switch being operated regularly to give this dosage of 40 Wh to every sq. ft. of soil surface in each 24-hour period. (45 Wh is recommended for Scotland and the north of England.) This heating continues until cropping commences and is cut off at the end of March.

Switching on and off is done manually, eliminating time-switches, although this is a wartime arrangement. It has been found useful to plan for all night running of the installation, which means a minimum of eight hours continuous heating, setting the limit of surface loading at about 5 W per sq. ft. For continuous running the low level is from 1·8 to 2·0 W per sq. ft. Experiments have been carried out mainly with lettuces and carrots raised in the same frame. Switching on the heat in January, the lettuces can be brought to maturity from about the middle of March to the middle of April, while the carrots are ready for cropping from the middle of May. Using the standard English garden frame of 6 ft. by 4 ft. the average number of lettuces that can be raised is forty-eight.

Paying Results

Results obtained from various parts of the country show that the consumption of a standard frame is from 80 to 90 kW which, on the basis of ¾d. per kWh, equals at most 5s. 4d. or about 1½d. per lettuce. Overhead costs of heating equipment and supply wiring amount to about the same figure, making a total cost of 3d. per lettuce. At the time when these lettuces were produced, the retail price was 10½d. each, a figure which is moderate for the current year's prices. No capital costs of a frame have been included in these calculations as it has been assumed that the gardener who proposes to use electrical heating already has a frame.

The experiments with this simplified method were carried out during 1941 and 1942 on from twenty to fifty frames in different districts. Many private gardeners co-operated in the scheme and, in addition, a number of horticultural institutions operated frames under expert control, acting as a standard of reference for the work in each district. The installations included both heating cable, running at mains voltage, and bare wire supplied from a step-down transformer. The results from these two types of set-up were similar. While the method has been produced to meet the requirements of amateur gardeners in war conditions, the results obtained indicate the possibilities of applying it successfully on a commercial scale. In the Midlands and the north of England cold frame production cannot generally be used satisfactorily for the earliest crops and the heated frame is valuable.

The success achieved so far with this simplified method suggests that it might be applied to raise various crops such as tomato, beetroot, radish and cucumber. Apart from simplicity of operation there are advantages in cleanliness and freedom from heavy work in comparison with the manure hotbed. Evidently there is a developing field for research.

In the nutrient solution field of horticulture the part played by electricity is a moderate one, consisting in the provision of a controlled or constant temperature for the plant roots. This form of culture, known sometimes as tank-culture or hydroponics, is an unorthodox method, although known to plant physiologists for some years as practicable for a wide range of plants. Soil cultivation will remain the normal and most practical method of crop raising for everyday purposes, but there are conditions in which solution culture has advantages. If a crop of high value is to be raised, free from soil-borne disease, and the grower's object is to secure a maximum return from a small area, he may obtain ideal conditions from solution culture. He will have controlled conditions of growth and will not need to have soil sterilisation. Tomatoes and lettuces, and carnations and other flowers have been successfully grown by this method, the carnations being produced on a commercial scale. Researches are being carried out in this field by Reading University in collaboration with the E.R.A., including the study of the effects of different solution temperatures on the growth of root systems.

Plant Irradiation

A further development in this field of controlled conditions is light irradiation. This has been applied to plants growing in soil, although the process has not reached the stage of commercial application. Work carried out on the Continent has shown that there is a direct connection between the maximum assimilation by a plant, the temperature at which this occurs and the degree of lighting needed. It appears that there is an optimum of lighting corresponding to each temperature and that it may be harmful to heat plants without giving them the proper quantity of light. So far, various types of lighting have been applied and there seems to be no certainty, as yet, as to the best type. Much research is yet to be done in this field.

Since timely supplies of water mean so much to the horticulturalist and the market gardener during drought, the provision of artificial irrigation is important. A drought may ruin an entire crop, so a number of market gardeners have already installed electrically operated irrigation equipment. On the Continent the "rain-cannon" has been applied, using a rotary sprinkler of a rectangular type consisting of horizontal pipes, oscillating under water pressure. These pipes are mounted on supports and have a number of fine vents which direct the water spray over a rectangular area. This unit is mobile and connects through a flexible hose to the nearest stand-pipe.

Another use of electricity in this field is the pumping and spraying plant for fruit trees, using a central plant, a mobile system or a hybrid system. Spraying is carried out far more frequently than in the past, using insecticidal and fungicidal washes at different times of the year, and powerful pumping units are needed to force the fine spray into the crevices of the trees.

Instrument Improvements

LARGELY as a result of its wartime experiences, the Baldwin Instrument Co., Ltd., plans a considerable expansion of its peacetime range of electrical instruments. When the company and its associated concern, Baldwin Electro-Medical, Ltd., commenced operations about twelve years ago, activities were confined almost entirely to instruments for measuring resistance, inductance and capacity, and instruments for use in X-ray therapy.

During the war considerable improvements in the design of their range of moving-coil volt and ammeters have been incorporated with the object of improving performance and saving weight. Square type dials are now available with standard drilling for 3½-in. round instruments, while models with illuminated dials have the lamps outside the casings at the back for easy replacement.

Besides developing an X-ray dosage meter dealing with currents in the order of 10^{-9} A, the company has produced instruments measuring currents down to 10^{-11} A, and has undertaken a good deal of work in connection with light-measuring instruments for use in map-making, colour-printing, etc. A sound level indicator for cinemas is another development.

A moisture meter for grain, wood, etc., which has been designed for mains operation, incorporates a mains transformer with a split secondary feeding the plates of two thermionic valves 180 deg. out of phase. The cell into which the specimen to be tested is placed is introduced into the phase-adjusting circuit, which feeds the grids of the valves, reading being given by a DC meter across the cathodes.

Views on the News

Reflections on Current Topics

A FEW days ago I had an interesting conversation on the future of electric heating of pottery kilns with Major Bernard Moore, the well-known ceramic consultant of Stoke-on-Trent, who for the past thirty years or so has made a special study of electrical methods and has designed several kiln installations, one of which, for firing china glost, was described in the *Electrical Review* of March 19th, 1943. Whilst looking forward to a greatly increased use of electric kilns, Major Moore is perturbed at the present high relative cost of electrical energy as compared with gas and is afraid that electrical methods will be severely handicapped if something is not done soon to improve the situation. Indeed he says he has already had several requests to convert electric kilns to gas because of high running costs.

Major Moore considers that the operation of coal clauses has in most cases practically doubled the cost of electricity for kiln heating, while gas tariffs, having no similar clauses, have remained nearly unchanged. This makes the cost of electricity approximately four times that of gas for the same thermal value. Major Moore has found that, at twice the cost of gas per therm equivalent, electricity is an economical proposition, as its efficiency is almost double that of gas, and he suggests that the high load factor of electric kilns (80 per cent. or so) should justify a substantial lowering of electricity rates to enable them to compete once more on at least an equal footing.

* * *

I mentioned this conversation to Capt. Thomas Lockett, O.B.E., manager of the Stoke-on-Trent Electricity Supply Department. While agreeing with Major Moore that the price of gas in Stoke is exceedingly low, Capt. Lockett does not see how an electricity undertaking can be expected to reduce charges which just about cover the cost of bulk supply and the lowest possible proportion of distribution and other necessary costs, and he suggests that it would be more logical to consider the possible trend in the local price of gas, which must at some time reflect the increased cost of coal and possible diminution in returns from residual sales, apart altogether from the additional capital charges which will have to be borne in respect of the considerable plant extensions which are now proceeding. One consultant at present engaged in putting in an electric glost oven at one of the largest factories has assured Capt. Lockett that he regards the Electricity Department charges as being quite economic having regard to what he calls the "better value received in the finished ware." One of the pioneers in pottery firing by electricity has also informed him that the existing tariffs would not be uneconomic even if they were slightly increased. In view of the number of electric kilns and ovens recently connected or projected (altogether about 2,000 kW), Capt. Lockett is not persuaded that the tendency will be for local potteries to adopt gas rather than electric firing.

* * *

Professional mathematicians are said to be content to devise a formula, leaving more humdrum minds to make what they can of it. But, as Captain Jack Bunsby used to remark, "the bearings of this observation lays in the application of it," and the application may involve effort beyond human powers. An anecdote to which the *Press Association* gives currency is that a Government Department started to work out a table of figures in connection with an urgent problem but it soon became evident that the job would take about 300 years. So machine aid was sought and the work was finished, checked and cross-checked within fifty hours, giving a "mechanical advantage" of more than 50,000 to 1. This raises the question of whether calculations that can be done more quickly by machines can be dignified by the name of "brain work." These thoughts are suggested by the establishment of a Mathematics Division of the Department of Scientific and Industrial Research which has just been announced.

* * *

Floodlighting is still regarded by most people mainly as a decorative or advertising device. Unfortunately this use is of course still prohibited on account of the fuel shortage, and it is therefore interesting to notice the increasing application of this form of lighting for quite legitimate and praiseworthy purposes. I hear that a Birmingham builder is using floodlighting to enable his men to get in another two hours' work after dark. The yet shorter days and the severity of the housing situation might commend this practice to others. Floodlighting is also finding increasing favour for outdoor night sporting events, apparently another permissible use, and I have just heard that the Clapton Orient Football Club has resumed its practice of coaching its young players (most of whom are at work during the day) at night by this means. There must be other opportunities for floodlighting to make possible outdoor relaxation in sport during the evenings.—**REFLECTOR.**

Building Specialists

Minister and Expert Advice

MR. GEORGE TOMLINSON, Minister of Works, was the principal guest at a luncheon of the Federation of Associations of Specialists and Sub-Contractors (of which the E.C.A. is a member) at the Dorchester Hotel, W.1, on November 29th. The president of the Federation, Mr. J. L. Musgrave, M.Inst.C.E., was in the chair and in proposing the toast of "H.M. Government" assured Mr. Tomlinson of the assistance of the Federation in his tremendous task of reconstruction. He pointed out that the various specialist trades primarily connected with buildings had ramifications extending into almost every factory of the country.

Some concern was being felt by specialists that in the reconstruction programme they were not being fully consulted. The Specialist Advisory Committee to the Ministry which had been set up was doing useful work, but it could only be fully useful if there were prior consultation with the Federation's representatives instead of these representatives having to make critical comments on decisions already made. Mr. Musgrave thought that necessary building of a communal character should be permitted to the fullest possible extent compatible with the efficient and speedy execution of the house-building programme.

He urged the Minister to carefully examine all the reports on economic building which had been submitted to the Ministry, including the one from the Federation on the placing and management of contracts. Proper wages should be paid to the sub-contractor and he should be sure of payment on completion; in this connection he referred to the Federation's suggested modifications in the wording and practice of the standard form of contract.

In the course of his reply to the toast, Mr. Tomlinson assured the president that he intended to seek the advice of people who knew how the job should be done. The Advisory Committee had been set up before his time; he had gone to the Ministry with a determination to listen to advice and not close any doors. From personal experience after the last war he knew what it was to be without a house; the urgency of the matter should be realised by everyone. He recognised that communal buildings were also necessary and that they should form part of a balanced building programme. He agreed that reports containing accumulated knowledge and experience should not be ignored and, as a trade union leader, he also agreed that people should be paid properly for their work.

More standardisation was essential in the building industry, including contracts, for efficient working and for the good of the public. He believed that with the assistance and co-operation of the industry the Ministry would overcome all the problems with which it was faced.

The health of the guests was proposed by Mr. Douglas Green, chairman of the Federation's Council, and Mr. A. Leonard Roberts, vice-president of the Royal Institute of British Architects, responded.

Dyeing Textiles

Drying and Moisture Control

TEXTILE dyeing and finishing machinery is commented on, with particular reference to drying and moisture control, in a paper read by MR. K. S. LAURIE before the Manchester Association of Engineers. Thermostatic temperature control is a feature while multi-speed and multi-motor drives are involved because of the need for cloth tensioning to regulate shrinkage of the fabrics.

Mechanical removal of moisture is by far the most economical within its limitations. For instance, a mangle may remove dyeing solutions from heavy cloth at the rate of 3 tons per hour with the expenditure of about 10 kWh whereas about 4,000 kWh would be required to remove the same quantity by heat. Even in the most favourable circumstances, however, mangling, centrifugal or suction extraction leaves a residue of about 50 per cent. of the dry weight of the cloth, which constitutes the real cloth-drying problem.

The residual moisture is removed by heat, usually a combination of conduction over hot rollers, convection in hot air and radiation from "infra-red" elements. The fan HP needed to produce high air speeds rises much more rapidly than the drying effect, while if sufficient heat to evaporate the water is provided electrically it will under present conditions cost six times as much as furnishing the same amount of heat by steam.

Experimental drying of fabrics by a battery of infra-red lamps has shown the efficiency of the operation to be less than 30 per cent. for dark cloth and less than 20 per cent. for white cloth. The efficiency of steam-heated air-drying machines approaches 50 per cent. Therefore the author concludes that infra-red drying is likely to cost from 10 to 15 times as much as steam-air drying. A drying machine evaporating, say, 600 lb. of moisture per hour requires approximately 1,200 lb. of steam, or

870 kW of infra-red heat. The utilisation of infra-red rays for plain heating, as distinct from drying, may have possibilities in curing plastic cloth finishes and similar applications.

An automatic method of control has recently been developed which continuously indicates the moisture content of the cloth and regulates the speed of the drying machine. A fairly high voltage from a step-up transformer is applied to the cloth by means of feelers, so that about 1 mA actually flows through the moist fabric at a distance about 25 per cent. back from the dry end of the machine. That small current flow serves to energise relays which operate the speed regulating gear by means of a small reversing motor, with impulse timing switches to prevent over-correction.

Another method of determining moisture content is to pass the wet cloth between two large plate electrodes forming part of a condenser circuit, so that change of capacity in conformity to moisture content enables the out-of-balance current to actuate speed controlling relays. The prevention of control "hunting" has recently been facilitated by the mathematical analysis of cloth-drying graphs, which has enabled the regulating relay to be appropriately designed.

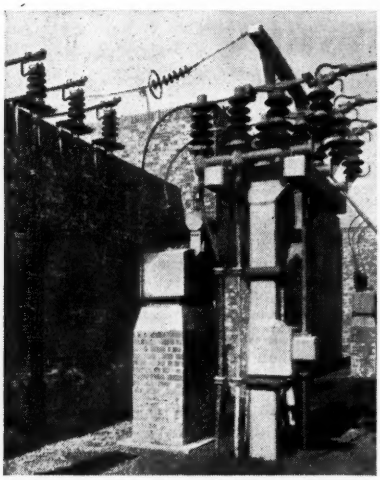
Cloth may be guided through mangles and drying cylinders mechanically, hydraulically, pneumatically or electrically by trigger switch actuating a solenoid. Rail guiders driven by reversing motors are severely limited by inertia when running cloth at high speed. Compressive shrinkage, particularly of cotton goods, is effected by contraction as the cloth passes between a hot shoe (which may be electrically heated) and a felt blanket turning over a small diameter roller before entering the calender, which imparts a smooth surface.

Cables at Ballylumford

Alternator and Transformer Connections

A DESCRIPTION of the war-emergency power station built for the Ministry of Commerce of Northern Ireland at Ballylumford, some 28 miles from Belfast, appeared in the *Electrical Review* of April 13th. Further particulars regarding the main cables installed in this station are given below.

The two 30,000-kW 33-kV alternators are each connected by two circuits in close trefoil formation composed of three 0·35 sq. in. single-core 33-kV impregnated-paper-insulated, lead-covered and served cables to busbars in the adjacent 33/110-kV outdoor switching and transforming station. These cables, 5,370 yd. in all, are secured by cast-brass clamps on above-ground sections, and carried on a steel structure over part of the route where ground conditions did not permit of laying direct. The accompanying photograph shows the terminal arrangements of No. 2 generator cables at the transforming site. At the left are 0·075-sq. in. 33-kV single-core impregnated-paper, lead-covered and served cables which supply one of the two 3,000-kVA 33/3·3-kV transformers feeding station auxiliaries. These transformers are connected to the station air-break switchgear by 3·3-kV 0·35-sq. in. three-core cables supported in porcelain cleats. The 3·3-kV distribution system required a total of 4,360 yd. of 0·35 sq. in. and 0·1 sq. in. three core p.i.l.c., served and single-wire-armoured cables.



Termination of 33-kV cable at outdoor switchgear

The 400-V supplies to the station auxiliaries involved the erection of 4,880 yd. of four-core p.i.l.c. cables having either served or single-wire-armoured finish and conductors ranging from 0·3 sq. in. to 0·0225 sq. in. For the control circuits 7,040 yd. of p.i.l.c. and s.w.a. multi-core cables having from four to thirty-two cores were erected.

In the control-room basement, porcelain cleats were used extensively for the power cables and for the control cables generally, except where it was more economical to support them in metal trays. The cables described above were supplied and installed by W. T. Henley's Telegraph Works Co., Ltd., together with more than 22,000 yd. of mineral-insulated cables having from two to seven cores and conductors of from 0·0045 to 0·0015 sq. in. Acknowledgments are due to Messrs. Kennedy & Donkin, the consulting engineers, for permission to publish the above particulars.

PERSONAL and SOCIAL

News of Men and Women of the Industry

A TELEVISION Advisory Committee has been set up by the Minister of Information to consult with representatives of the industry. The members of the committee are Mr. G. M. Garro-Jones (chairman), Mr. R. J. P. Harvey, Treasury; Col. Sir Stanley Angwin and Mr. H. Townsend, Post Office; Mr. H. A. Binney, Board of Trade; Mr. E. B. Bowyer, Ministry of Supply; Sir Edward Appleton; Mr. O. F. Brown, Department of Scientific and Industrial Research; Mr. E. St. J. Bamford and Mr. H. G. Welch, Ministry of Information; Mr. W. J. Haley and Sir Noel Ashbridge, B.B.C.

Mr. Herbert Morrison, Lord President of the Council, announced in the House of Commons last week that he is to appoint a committee of leading scientists and others to consider the policies which would govern the use and development of Britain's scientific man-power and resources in the next ten years. The committee will include Sir Edward Appleton, Sir Alan Barlow, Professor Blackett, Mr. Geoffrey Crowther, Sir Alfred Egerton and Sir George Nelson. Sir Alan Barlow is to act as temporary chairman.

Mr. L. S. Atkinson has been elected chairman of the Junior Institution of Engineers, with **Mr. P. W. Dunn** and **Mr. A. C. F. Mackadam** as vice-chairmen.

The appointment of **Mr. D. R. Williams**, B.Sc. (Eng.), M.I.E.E., A.M.I.Mech.E., F.Inst.F., as borough electrical engineer and manager of Grimsby has now been confirmed.

Mr. D. R. Williams

Born at Penrhiwceiber in 1908, Mr. Williams was educated at Ellesmere College and the City and Guilds Engineering College, Imperial College of Science. After receiving practical training in Switzerland with Brown Boveri & Co., and Sulzer Bros., he became commercial assistant to the Shropshire, Worcestershire & Staffordshire Electric Power Co. in 1932, and a year later assistant electrical engineer to the Powell Duffryn Steam Co., Ltd. In 1935 he was appointed technical engineer to the Powell Duffryn Associated Collieries, Ltd., being closely associated with extensions to its generating and transmission systems, which included the installation at the Bargoed station of forced circulation boilers operating at 1,560 lb. per sq. in. and the provision of some of the first air-blast switchgear in this country operating at 33 kV. From 1939-1944 Mr. Williams was technical assistant and constructional engineer to the West Midlands J.E.A., and last year he became deputy chief engineer to the Stretford & District Electricity Board. Mr. Williams has paid various visits to the Continent and America to investigate the latest engineering practice.

Mr. W. H. Ashley, who for the past fourteen years has been chief engineer of the Indian Radio & Cable Communications Co., Ltd., Bombay, has relinquished this post and has taken up an appointment with Marconi's Radio Telegraph Co., S.A.E., Cairo.

Mr. W. H. Ashley

Two employees of W. T. Henley's Telegraph Works Co., Ltd., North Woolwich Works, **Mr. G. W. Tomlinson**, a braider, and **Mr. S. F. Lindfield**, of the Carpenter's Department, recently received presentations from the chairman, Sir Montague Hughman, commemorating their completion of fifty years' service with the company. Fourteen other employees of Henley's North Woolwich Works received long service certificates for completing twenty years' service.

Mr. Alex. McNicol, superintendent at Pinkston (Glasgow) power station, is retiring on attaining the age limit. **Mr. Alex. K. Balfour**, who has been deputy power station superintendent since 1933, is to succeed him at a commencing salary of £664.

After forty-two years with the North-Eastern Electric Supply Co., Ltd., **Mr. W. F. T. Pinkney**, M.I.E.E., assistant general manager, is to retire at the end of this year.

Mr. W. F. T. Pinkney

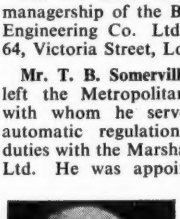
Mr. Pinkney, who is a native of Bute, was educated at Sherborne School and apprenticed to the Sunderland Forge & Engineering Co. He joined "Nesco" as a junior engineer, and from 1914 to 1937, as chief engineer, Lighting and Heating Department, was responsible for a considerable amount of the development work of the undertaking. For a number of years he was on the Council of the Electrical Development Association and

he is a past-chairman of the E.D.A. Northern Counties Area. During the war Mr. Pinkney served on the Newcastle-on-Tyne Advisory Committee on Fuel. He is very expert with the camera and is a Fellow of the Royal Photographic Society.

Mr. C. F. Batstone has been appointed Midland branch manager of the British Aluminium Co., Ltd. **Mr. E. V. Pannell** will be retiring at the end of the year after thirty-four years' service with the company.

Mr. W. Clark has relinquished the works managership of the British Vacuum Cleaner & Engineering Co. Ltd. His present address is 64, Victoria Street, London, S.W.1.

Mr. T. B. Somerville, B.Sc., A.M.I.E.E., has left the Metropolitan-Vickers Electrical Co., with whom he served for several years as automatic regulation engineer, to take up duties with the Marshall Richards Machine Co., Ltd. He was appointed a director of that company last year and is now in the United States studying certain aspects of his new business. Mr. Somerville was educated at Armstrong College, Durham University, and served his apprenticeship with Metropolitan-Vickers.



Mr. T. B. Somerville

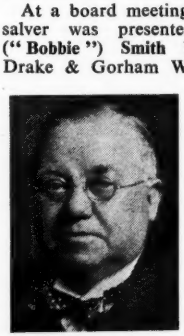
Owing to business reasons **Mr. C. E. R. Hickman,** has had to resign from the secretaryship of the Electrical Trades' Commercial Travellers' Association. The new secretary is **Mr. J. C. Stewart,** 50, Lower Downs Road, West Wimbledon, S.W.20.

Mr. George Bowman, hon. secretary of the Carlisle Branch of the Electrical Contractors' Association and also secretary of the North-Western Branch of the E.I.B.A. has been elected a member of the Carlisle City Council. He stood as an independent candidate and was returned with a handsome majority.

Councillor P. H. Goddard of the British Thomson-Houston Co., Ltd. (Industrial Sales Department), who was for some years a member of the Central England Executive of the I.M.E.A. and was a member of the I.M.E.A. Council for 1944-45 has been re-elected chairman of the Rugby Corporation Electricity Committee for the ensuing year.

Accompanied by **Sir George E. Bailey,** managing director of Associated Electrical Industries, Ltd., **Mr. Oliver Lyttelton,** who was recently appointed chairman of A.E.I., visited the Rugby Works of the British Thomson-Houston Co., Ltd., last week. The managing director Mr. H. W. H. Warren and other directors of the B.T.H. Company introduced the visitors to the heads of the Research Engineering, Manufacturing, and Commercial Departments. Afterwards a tour of the Rugby works and laboratory was made.

At a board meeting on Wednesday a silver salver was presented to **Mr. R. Wilson ("Bobbie") Smith** by his co-directors of Drake & Gorham Wholesale, Ltd., to mark the completion of fifty years' valuable work with the company of which he is managing director.



Mr. R. W. Smith

Wives and friends of members of the Association of Mining Electrical and Mechanical Engineers will be able to attend a matinee of "Robinson Crusoe," at the Grand Theatre, Leeds, on Saturday, February 16th, to be followed by dinner at the Griffin Hotel. Applications for tickets for both theatre and dinner (18s. 6d.) should be made by December 8th, to Mr. F. N. Bevan, c/o the Liverpool Electric Cable Co., Ltd., 40, York Place, Leeds, 1.

Mr. J. Vaughan Harries is leaving the head office staff of the South Wales Electrical Power Co. at St. Mellons, Cardiff, to take up the position of South Wales manager of the Brush Electrical Engineering Co., Ltd. Before joining the power company Mr. Harries was electrical engineer at the Lady Windsor Collieries at Ynysybwl, Monmouthshire. He is assistant hon. secretary of the Western Centre of the Institution of Electrical Engineers.

Mr. W. H. Copper, who has been appointed manager of the London Branch of W. T. Henley's Telegraph Works Co., Ltd., has been with the company for twenty-five years. For some time he has been in charge of the organisation which was established in London whilst Henley's head office was at Dorking during the war; this organisation will in future be known as the London Branch; there is no change in the address, which is 51/53, Hatton Garden, London, E.C.1 (telephone: Chancery 6822), the same address as Henley's head office.

Mr. W. H. Copper

The G.E.C. Dramatic Society recently presented Daphne Du Maurier's "Rebecca" for six nights and one matinee. With the exception of the matinee performance, all seats

were sold some days before the opening night. "Rebecca" was an ambitious choice but the G.E.C. players succeeded in overcoming all difficulties The cast included: Horace Haynes, Irene Herod, Douglas Maule-Cole, Richard Anson, Victor Garland, Doris Emm, Evelyn Grey, Elsie Walbancke, William Peacock, Phyllis Redman, Harold Bowman, Robert Scutt and Stanley Wells.

The play was produced by Dudley Pearmain and the setting was by William Peacock. The stage management was in the hands of Ella C. Barnett. The proceeds of the show (exceeding £100) will be handed over to the G.E.C. Well Wishers' Club for the purchase of comforts for members of the Magnet House staff serving in the Forces overseas.

We reported in our November 2nd issue that **Mr. J. F. Wallace** had been nominated by the National Executive Council of the Electrical Power Engineers' Association to succeed Mr. W. Arthur Jones as general secretary of the Association. His appointment has now been confirmed. Mr. Wallace was appointed Northern Area secretary in 1921 and later became assistant secretary since when he has been in charge of negotiations in North-East England, Scotland, Ireland and North Wales. He has been secretary of the staff side of the Nos. 1, 2 and 13 District Joint Boards and a member of the National Joint Board. Mr. Wallace has made frequent contributions to the technical press.

Mr. J. F. Wallace

Flight-Lieut. H. V. Crosse, R.A.F. has been demobilised and is rejoining the "Maxlume" sales staff of Veritys, Ltd., London.

Mr. H. M. Bishop, B.Sc. (Eng.), A.M.I.E.E., of Bedford, has been appointed mains superintendent to the Hoylake Electricity Department in succession to Mr. H. Darling, who resigned on October 31st.

Mr. C. E. Rockwell, who until his resignation last October, was director and general manager of E. H. Jones (Machine Tools), Ltd., has formed the Rockwell Machine Tool Co. (temporary address: 1, Halsbury Close, Stanmore) to market a range of British and American power presses and machine tools.

Mr. W. Hancock, chief electrical engineer Royal Ordnance Factory, Swynnerton, Staffs, since 1940, has been released by the Ministry of Supply, and is taking up a directorship of the Victoria Heating & Ventilating Co., Ltd. Mr. Hancock is a member of the Stoke-on-Trent City Council and was chairman of the Electricity Committee from 1943 to 1945. He is also chairman of the Technical Operating Committee of the North West Midlands Joint Electricity Authority.

Major J. K. Haynes, A.M.I.E.E., who has served throughout the war in the Royal Corps of Signals, has joined the staff of Parmeko, Ltd,, Leicester, as London representative.

The appointment of **Mr. J. Samson,** A.M.I.E.E., of Cheadle, as electrical engineer to the Atherton (Lancs) Urban District Council is reported in *Municipal Engineering*.

Glasgow Corporation is advertising in this issue for a chief electrical engineer for the Transport Department. The salary for the position is £750 (rising to £900) plus a war increase which is at present £60. Heckmondwike U.D.C. invites applications for the position of electrical engineer and manager at a salary in accordance with the agreement of the National Joint Committee. The Stretford and District Electricity Board requires a deputy chief engineer (£800 rising to £950, plus war bonus, at present £49 16s.), and Coventry Electricity Department a consumers' engineer (salary at present £724 rising to £759).

Obituary

Mr. J. B. Palmer.—We regret to report the death of Mr. J. B. Palmer, of the Metropolitan-Vickers Electrical Co., Ltd. He had occupied successively positions as transformer designer, mechanical and development engineer, transformer sales manager, manager of the Belfast office and acting manager of the Manchester office. His earlier days included apprenticeship at the Thames Iron Works, Ltd., and experience with the London Underground Railways. He also visited the United States to study h.v. transformer practice. His interests were varied and included aviation and gliding.

Mr. James Henderson.—We regret to report the death, on November 20th at his home in Leatherhead, of Mr. James Henderson, J.P., whose retirement from the board of the United Steel Companies was recently announced.

X-rays in Engineering

SOME engineering aspects of the production of X-rays are dealt with in a paper prepared by MR. R. A. BRIGGS for the London Students' Section of the Institution of Electrical Engineers.

After explaining how the electromagnetic radiation known as X-rays occurs the author describes early gas-type tubes and the Coolidge hot-cathode type on which the design of modern tubes is based. The generation of high voltage by transformers and valve oscillators is next dealt with and the meanings of "image" and "scatter" are explained. References to the use of X-rays for engineering inspection are followed by an outline of X-ray crystal analysis.

Overseas Electrical Trade

Return for First Nine Months of 1945

THE latest overseas trade return published by the Board of Trade covers the nine months to the end of September last. The value of exports of electrical equipment, as shown in the accompanying table, was £18,675,005, compared with £18,175,365 in the corresponding period of 1944 and £16,327,043 in the first three-quarters of 1938. Imports amounted to £20,829,651, compared with £18,516,526 in 1944, and a mere £2,839,380 in 1938 (in each case the year referred to means the first nine months). Much of this large increase in imports was in radio equipment.

Exports of goods and apparatus alone (excluding machinery) were valued at £9,786,666 against £9,982,182 in 1944 and £10,072,804 in 1938. For purposes of determining the volume represented, the index numbers of average values (1938 = 100) are given as 175 last year and 169 this year. The "machinery" indexes for the two years are 164 and 169 respectively.

No general trend is discernible as regards the markets to which equipment has been sent. The value of goods and apparatus shipped to Australia for example dropped from £2,186,890 to £1,852,765 and to New Zealand from £1,497,275 to £763,682, while shipments to South Africa rose from £1,125,568 to £1,302,443; to British India from £1,168,968 to £1,650,226; and to British East Africa from £90,781 to £152,316. Among other markets, an increase from £102,137 to £260,384 in the case of Eire is noteworthy. Exports to Egypt were up from £156,511 to £228,916; Iran from £96,523 to £157,843 and Argentina from £30,585 to £60,838, although the last-named amount remains small compared with the 1938 figure of £408,482. Electrical machinery exports, as might be expected, were swollen by shipments to the Soviet Union. The value of generators sent there this year has amounted to £562,655 (compared with £33,417 in 1938); motors £465,518; and "other electrical machinery" £4,463,870 (in this category exports to Russia in 1938 were included among those to "other foreign countries," total value £609,823).

Class	Exports		Imports	
	Jan.–Sept., 1945	Inc. or Dec. on Jan.–Sept., 1944	Jan.–Sept., 1945	Inc. or Dec. on Jan.–Sept., 1944
	£	£	£	£
Telegraph and telephone wires and cables (submarine)	255,757	+ 11,438		
Ditto (not submarine)	666,822	− 112,182	1,088,973	− 1,616,049
Wires and cables other than telegraph and telephone (rubber-insulated)	1,229,508	+ 128,091		
Ditto, insulation other than rubber	1,030,152	+ 15,290		
Radio receivers (not radiograms)	95,795	+ 16,517	310,244	− 843,919
Transmitting apparatus	300,731	− 434,872	*	—
Valves	592,848	− 500,289	783,816	− 277,626
Other radio parts and accessories	375,996	− 240,292	10,985,071	+ 3,906,034
Telegraph and telephone apparatus other than radio	1,818,961	+ 622,278	702,978	+ 164,111
Electric carbons, furnace	*	—	4,148	− 374,913
Other electric carbons	*	—	97,844	− 3,941
Lamps	588,636	+ 166,687	187,156	− 294,775
Other lighting apparatus	339,992	+ 48,677	247,219	+ 163,962
Primary batteries	114,932	+ 5,929	263,821	+ 121,547
Accumulators (portable)	290,536	+ 62,907	*	—
Ditto, stationary	25,196	− 88,441	*	—
Ditto, parts and accessories	124,946	+ 17,268	*	—
Electric cooking and heating apparatus	170,626	+ 90,002	*	—
House service meters	79,108	+ 17,117	221,301	+ 47,157
Other electrical instruments (not telegraph and telephone)	325,379	− 29,402		
Insulating materials n.e.s.	221,195	+ 41,498	*	—
Unclassified electrical goods and apparatus	1,139,550	− 33,737	3,323,851	+ 2,231,851
Generators up to 200 kW	585,120	+ 18,067	*	—
Ditto, over 200 kW	598,237	− 653,197	*	—
Motors	1,211,206	+ 138,865	87,880†	+ 34,503
Converting machinery	11,150	+ 1,237	*	—
Transformers for lighting, heating and power, including coils	1,015,805	− 62,382	*	—
Rectifiers for power-house use	40,740	+ 2,549	*	—
Motor starting and controlling gear	266,589	+ 9,354	*	—
Switchgear and switchboards other than telegraph and telephone	1,772,491	+ 704,918	*	—
Other electrical machinery	3,338,022	+ 506,453	2,523,853	− 946,307
Electric vacuum cleaners	17,246	+ 15,254	1,496	+ 1,496
Other electrically operated portable appliances	31,733	+ 14,038	*	—
Total	18,675,005	+ 499,640	20,829,651	+ 2,313,125

* Not separately classified. † Not railway and tramway motors.

Rotor Windings

Causes and Cure of Distortion

HOW the operation procedure for large turbo-alternators has been modified to reduce the risk of their rotor windings becoming deformed by changes of temperature is described in some detail in a paper prepared by Mr. R. H. COATES (Portsmouth Corporation) and Mr. B. C. PYLE (Sheffield Corporation) presented before the Institution of Electrical Engineers.

It is pointed out that generator failures as the result of distortion of the copper in their rotors now constitutes a major cause of "outage" of power plant. Particulars and duration of rotor failures are tabulated with a detailed explanation of the nature of faults causing outage as revealed by inspection at the makers' works during repair of the machines. Failures of this kind reached a peak in 1943-44 and at one time 110,000 kW of generating plant was out of commission.

It appears from the authors' experience that machines can run for many years and be started and stopped over a thousand times before trouble of this nature makes itself apparent. They believe that there are to-day many machines in operation in this country which are incapable of indefinitely withstanding present requirements (daily shutting down and normal running at full load for many hours) in contrast to pre-grid rarity of such needs. In their detailed investigation of the causes of distortion of rotor windings the authors have expanded existing theories based on the work-hardening of copper by cyclic temperature changes. They present data on the plastic deformation of copper at working temperatures and measured temperatures and stresses in the windings of large alternator rotors in service and describe equipment installed to measure and control those factors.

Analysis of the phenomena imposing the stresses has indicated means of limiting them by precautionary modification of operational procedure, which is intended to reduce the temperature drop of rotors when machines are taken off load; some of the consequential difficulties are also outlined as well as the manner of preheating rotors electrically before machines are reconnected to the system busbars.

A final brief reference to economic considerations indicates that the cost of outages caused in this particular way is heavy. Throughout the country as a whole, it is estimated that copper shortening, which causes double earth faults in different ways, has in the aggregate already cost over £1,000,000 and more than a million tons of coal. The authors refer to the congestion at makers' works of alternator rotors undergoing repairs.

Power for Aerials

Design of Suitable Systems

THE design and use of various types of open-wire power lines and associated switchgear for conveying energy at radio frequencies ranging from 0·2 to 25 Mc/s from the transmitters to the aerials at B.B.C. stations are described in a paper by MESSRS. F. C. MCLEAN and F. D. BOLT (B.B.C.) read before the Radio Section of the Institution of Electrical Engineers. Impedance, attenuation and power-carrying characteristics, together with the results of various tests and general details of construction as well as methods of matching the load to the transmission line are dealt with. The paper is written from the point of view of the engineer engaged on design and practical work in the field; data are included by the authors which will enable the most suitable type of line to be designed for any particular transmission need.

The choice of line is largely determined by power considerations, hence voltage; but attenuation must be minimised, even at the cost of heavier transmission lines, for the following reason. A loss of 5 db at a 800-kW station would mean a loss of 89 kW of radio-frequency power, which is equivalent to a loss of 300 kW at the input mains. The four-wire line is now in general use for powers above 50 kW. The basic decisions reached in the case of the Daventry station have not been changed, but the method of construction has been steadily improved and, at the same time, its cost has been reduced owing to

simpler mechanical construction and the use of longer spans.

Line-switching with manual selection is of some complexity, so that considerable attention has been devoted to methods of automatic selection. The system finally chosen involves terminating all aerials on a circular frame 140 ft. in diameter, at the centre of which is an octagonal line-switching tower, 40 ft. high and 14 ft. across, having a number of levels corresponding to the number of transmitters, operating on the Geneva-wheel principle, gear driven by motor. The mechanical design of the " motion " was due to Clarke, Chapman & Co., Ltd.

The paper concludes with an explanation of the relationship between the costs of generating power at the valves and its transmission by lines to the aerials, indicating how minimisation of losses is affected by the amount of copper invested in the system and the size of line.

Synthetic Mica

German Production of Substitutes

TWO reports summarising information obtained by investigations in Germany into the manufacture of synthetic mica and a substitute for the natural product have been released for the information of, and use by, all producers in the United Kingdom.

Copies of both reports are obtainable from the Mica Trade Association, 69, Cannon Street, London, E.C.4, and in making the information available the Ministry of Supply points out that " publication in this manner " cannot confer protection against action for infringement of British patents which may cover the subject matter of the reports. Any person proposing to use the information in them should therefore satisfy himself that he is not liable to such action.

One of the reports, compiled by the Combined British Intelligence Objectives Sub-Committee, outlines a process of making synthetic mica as developed by the K.W.I. Ceramics Institute, which was evacuated from Berlin to Ostheim and nearby villages in Thuringia. Research started in 1941 and was completed by the K.W.I. Silicat Forschung in March, 1945, the resulting process being an improvement of the method patented in 1919 by the Siemens & Halske as well as the Westinghouse concerns. The report summarises data on the composition of the mix and the manner of melting and cooling it. Electric resistance furnaces would be preferred commercially and a magnetic field applied at right angles to the vertical axis of the crucible is needed for crystallisation of the material in large sheets.

The other report is an American press release (Office of the Publication Board, Department of Commerce) dealing with German technical intelligence on glass fabric as a substitute for mica between segments of the commutators of motors and generators. The report contains data on the fabric specification and preparation of the impregnating solution (one constituent of which is made by electrolytic deposition) as well as precautions to be taken during moulding and physical characteristics of the finished insulating material.

Municipal Reports

Douglas (I.o.M.)

EXCLUDING bulk supply, Douglas Electricity Department sold 9·4 million kWh in 1944-45 (compared with 8·2 million the previous year), equal to 374 (328) kWh per head of the population. Total revenue was £165,221 and working expenses were £114,104. Revenue was equal to 1·86d. per kWh sold (against 1·74d. in 1943-44) and working expenses averaged 1·28d. (1·27d.). After meeting loan charges of £15,715 the balance on the net revenue account (£11,908) has been transferred to the reserve fund.

Electricity generated by the Department during the year totalled 23·6 million kWh, an increase of 2·7 million kWh (13 per cent.). Damage was done to the North Quay power station when the flywheel of a Diesel engine burst through failure of the governor mechanism. Following the breakdown it was decided to install rectifying equipment instead of carrying out repairs to the Diesel plant. The borough electrical engineer and manager (Mr. Bertram Kelly) reports that at the suggestion of the I.O.M. Electricity Board a Joint Board has been set up to negotiate salary scales and conditions of service for the electricity supply technical staff in the Isle of Man.

Sale

Comments on financing capital expenditure from revenue are made in the report of the borough treasurer of Sale (Mr. J. A. Gent) on the 1944-45 accounts. He says it is not good policy to starve the working balance in this way because revenue expenditure is always in advance of income. A sound margin is about five-twelfths of the annual revenue turnover, representing a balance of say, £39,000, but if contemplated appropriations are spent the balance will fall to about £33,000. For the past year income amounted to £93,047 (against £83,790) and working expensss were £80,267 (£65,796), there being a net profit after payment of loan charges of £2,842 (£8,000) which is appropriated for capital expenditure. The undertaking, of which Mr. J. B. Lees is chief engineer, sold 17·1 million kWh at an average price of 1·19d. compared with 14·5 million and 1·26d. in 1943-44.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Supplies to Farms

MR. L. DOUGLASS of the Isle of Man Electricity Board inquired recently concerning the problem of supplying farms some distance from the Board's lines; farms that is, with a rather limited load. There are two means by which the problem may be successfully met.

First, persuade the farmer to go all electric, and help him to do so by hiring at easy rates the apparatus necessary, and asking him to agree to take electricity to, say, the value of £15 a year for at least three years. That has proved successful in one part of Lincolnshire, where a bungalow a quarter of a mile from the nearest line and the next neighbour a further 350 yd. away were supplied on that agreement. The owner of the bungalow, being an electrical engineer, snapped at the agreement, persuading his farming neighbour to do the same, with the argument that as they had to pay for the electricity they should go all-electric and cut out coal, coke, etc. The project suited all parties and proved a paying proposition.

If this will not solve the problem, the local ruling body, the Tynwald in this case, could appoint a committee to act and report within three weeks as to whether equipping of the farm in question and supplying it with energy at the normal rate per kWh would be of advantage to the community as a whole, whether life will go better there, more work would be done and more food grown, with the same labour, on the same land and, in particular, if it will ease the water supply to the premises, and so reduce the gruelling and costly work carrying water about.

If these questions are answered in the affirmative, put the supply in, hire out apparatus, charge the ordinary tariff, and let the community, which benefits from the added efficiency, pay the difference.

Sheffield. W. T. WARDALE.

Single-Pole Fusing

THE question of single-pole fusing needs serious consideration and I agree with the observations of Mr. H. R. Mann. It certainly cannot be guaranteed that the neutral conductor will always be at earth potential and an equally important point is that there are too many unqualified people carrying out installation work.

A large number of single-pole switches in buildings are already connected to the neutral conductors and it is equally possible to connect the neutral to single-pole fuses.

As Mr. Mann states, d.p. fusing is the lesser of two evils and everything possible should be done to discourage amateurs by deprecating single-pole fusing.

Glasgow. ALEX. MILNE.

Choice of Textbooks

MR. J. P. CLARKE'S young friend might care to start his electrical library with the following:—

"Standard Handbook for Electrical Engineers" (McGraw Hill Book Co.); "Power Wiring Diagrams" by Dover (Pitman); "Spon's Electrical Pocket Book" by Molesworth (E. & F. Spon); "The Calculation and Design of Electrical Apparatus" by Wilson (Chapman & Hall); and "Telephony," two volumes, by Herbert & Procter (Pitman).

Inverness. W. R. CUMMING.

Hyderabad Schemes

A NOTE in *The Times* gives details of two large-scale projects which have been launched by the Nizam of Hyderabad. One, the Tungabhadra irrigation scheme, will provide more than 100,000 kW of hydro-electric power; the total cost is estimated at £15 millions.

Even more ambitious is the Godavari industrial and agricultural development scheme which envisages hydro-electric and irrigation development, a new industrial town, a balancing thermal power station and exploitation of mineral resources, including coal, iron ore, mica, graphite and limestone. The first £20,000,000 has been set aside for it and a survey of the upper reaches of the Godavari river for the purposes of inland navigation has been approved. The Nizam's Government has agreed to the scheme and an organisation on lines similar to the Tennessee Valley Authority in America is being set up. It is proposed to dam the river Godavari where it drains a catchment area of 35,740 square miles. Its canal system will cover an area of 3,750,000 acres and it will be possible to bring nearly half of this area under irrigation annually. There are drops in the canal which will be utilised for the generation of hydro-electric power. It is hoped to complete the major part of this ambitious programme within the next ten years.

Standard Fittings for Houses

IN its Circular 188/44 sent to housing authorities in December last year the Ministry of Health stressed the need for using materials and components conforming to British Standard Specifications. Now it has sent another circular (211/45) to the authorities stating that while the standards should be conformed to wherever possible it is realised that the extent to which this obligation can effectively be carried out must depend upon the supply position. It has therefore been decided to limit the obligation to materials and components for which standardised products are already in production or can readily be brought into production, a list of which is appended to the circular. Special circumstances may prevent conformity and in such cases the obligation will be waived. These circumstances include cases in which working drawings and specifications incorporating non-standard products have already been completed; when building is in accordance with pre-war plans; when extensions are to be made to complete a pre-war housing estate; and where existing houses are being repaired, adapted or converted.

Included in the above-mentioned appendix are the following electrical materials and accessories: Ceiling roses (B.S. 67/1938); cast iron conduit boxes (820/1938); steel conduit and fittings (31/1940); cooker control units (438/1941); distribution boards (214/1939); switches (816/1938); lampholders (52/1941); fuses (88/1939); paper-insulated cables (480/1942); and rubber-insulated and p.v.c. cables and flex (7/1939).

Material Testing Methods

MANY of the available methods of non-destructively testing metallic materials are surveyed in a paper submitted by DR. J. E. GARSIDE to the Manchester Association of Engineers. A number of them are electrical and they are suitable for employment industrially because they do not require elaborate or expensive equipment or highly trained operators. A bibliography is included of 31 references to methods which have been fully described elsewhere.

Starting with the determination of chemical composition by physical methods, mention is made of magnetic testing by means of the "Carbanalyser" which indicates whether the sample will deflect a small compass needle. Alternative AC circuits have been developed that include a cathode-ray tube as the indicating instrument.

Spectrochemical analysis with the aid of arc or high-voltage spark radiation is commented on as well as electrographic analysis which is said to have been developed extensively; current flow through the metal specimen in contact with photographic paper causes ion migration to form coloured patterns on the paper.

Among means of determining mechanical properties a circuit is included for indicating so-called "magnetic hardness." Wall thickness may be gauged by the Thornton and Warren conductivity methods, while a Tait meter can be used for electro-magnetically measuring the thickness of a non-magnetic coating on a magnetic base metal: The thickness of non-magnetic metals may be found by the use of eddy currents and an electronic method is available for measuring the thickness of non-magnetic films over non-magnetic alloys.

Surface defects can be detected by the application of fluorescent substances under ultra-violet light; ferrographically with the aid of "magnetic detecting ink"; or by eddy currents in conjunction with a cathode-ray indicator. An interesting development is the "photo-induction Defectoscope." Internal defects in metals are revealed by magnetic and conductivity tests or by acoustical means with ultrasonic radiation as well as radiological examination.

Plug–socket Demonstration

A DEMONSTRATION arranged by the Ministry of Works in collaboration with the National Physical Laboratory in the lecture theatre of the Institution of Electrical Engineers during the early part of last week was not intended to "support any particular solution of the plug and socket problem." The object was to determine the temperature that would be attained by normal 5-A circuit wiring (v.i.r. 1/·044 and 3/·029) when loaded to 15 A and, at the same time, to ascertain the temperature rise at the contacts of the various types of plugs and sockets of different makes included in the demonstration circuit.

Coloured lay-out charts and circuit-connection diagrams were provided as well as thermometers and electrical measuring instruments to enable readings to be logged systematically during the loading period. But by some peculiar oversight, or omission, not one switch-plug combination had been included in the demonstration circuit, which fact aroused curiosity that could not be satisfied. Everyone knows that whereas some plugs and sockets may perhaps be safely up-rated, a switch as ordinarily designed for 5 A can hardly be expected to carry 13 A without becoming overheated to an unsafe degree.

Coal Deterioration Allowances

POPLAR Electricity Committee has had a report in connection with the Coal Utilities Joint Committee which has been set up to deal with complaints arising out of claims for allowances for deterioration in the quality of fuel supplies. A claim by the Council, which incidentally was the first case to be considered by the Joint Committee, has proved successful and has resulted in an allowance being granted on 556 tons 10 cwt. at 7s. 6d. per ton, namely, £208 13s. 9d.

COMMERCE and INDUSTRY

Ministry of Supply's Functions. Scottish Electricians' Wages.

Government and Engineering

IN a statement to the House of Commons on October 29th concerning the division of responsibilities between the Board of Trade and the Ministries of Supply and of Aircraft Production (the last two of which are to be amalgamated into one new Ministry as soon as practicable), the Prime Minister said that the new combined Ministry would carry the primary Government responsibility in the field of engineering. Rearrangements of inter-Departmental machinery have now been completed for the transfer of responsibility from the Board of Trade to the Ministry of Supply consequent upon this decision. This took effect on Monday last, December 3rd. Organisations and firms in the engineering industry which have hitherto looked to the Board of Trade for advice and assistance should now normally make their approaches to the Government on similar matters through the Ministry of Supply. The headquarters organisation concerned is Engineering Industries Division, Ministry of Supply, I.C. House, Millbank, London, S.W.1 (telephone: Whitehall 5140). The transfer of Board of Trade responsibilities in this respect includes the mechanical engineering and electrical engineering trades, except electrical fittings (ceiling, wall, standard, portable or pendant); and scientific instruments and laboratory apparatus, surgical and hospital instruments and equipment, photographic and optical equipment, and accessories therefor, and mathematical instruments.

Electricians' Wage Increase

Mr. E. W. Bussey, general secretary of the Electrical Trades Union, has issued a statement pointing out that the increase recently granted to electricians and adult mates employed in the electrical contracting industry does not apply to workers in Scotland, employed under the Scottish Electrical Contractors' Association, who will receive an increase of 2½d. an hour to operate from January 1st.

Kitchen Exhibition at Sheffield

An exhibition of electric kitchens was opened recently in Sheffield by the Lord Mayor (Alderman C. W. Gascoigne, J.P.) in the presence of Councillor J. W. Holland, J.P., chairman of the Electricity Committee, Mr. J. R. Struthers, general manager of the Corporation Electricity Department, Mr. V. W. Dale, general manager and secretary of the British Electrical Development Association, and a large assembly. The exhibition which has been arranged by the Electricity Department in conjunction with E.D.A., is housed in two marquees on a "blitzed" site in the centre of the city.

The main feature is the four E.D.A. electric kitchens for the low-cost post-war home. A fifth kitchen has been constructed by the Electricity Department using Moffat all-steel equipment. In addition ten display stands have been equipped with electrical appliances of all types, and a special water-heating display has been arranged. Cookery demonstrations and film shows are given daily. Considerable public interest has been shown in the exhibition and in the first two weeks it has been visited by 55,000 people. Arrangements for the display have been in the hands of Mr. A. Haddock.

Displays of electrical appliances at the Sheffield exhibition of electric kitchens

Public and Private Enterprise

The relation between Government and private enterprise was discussed by Sir Clive Baillieu, president of the Federation of British Industries, at a meeting at Manchester on November 30th, Mr. H. Allcock, M.I.E.E. (W. T. Glover & Co., Ltd.), chairman of the Manchester District Committee of the Federation, presiding. Sir Clive Baillieu said that they must avoid becoming involved in a battle of conflicting ideologies. In saying this he did not qualify his profound belief in the saving virtue of private enterprise which in his view constituted the best basis for a prosperous national economy. The plain inescapable fact was that Government and private enterprise had appropriate roles to play, which should be complementary, and the battle of reconstruction would not be won unless they operated in close and friendly alliance. Attempts to substitute one for the other over the whole field of the nation's industry and commerce must result in acute social strife and might well involve the country in disaster. All industry, whether under public ownership or private enterprise, must justify itself by works

and performance, not by protests and promises. Industries operating under public ownership should do so under conditions no less exacting than those developed under private enterprise.

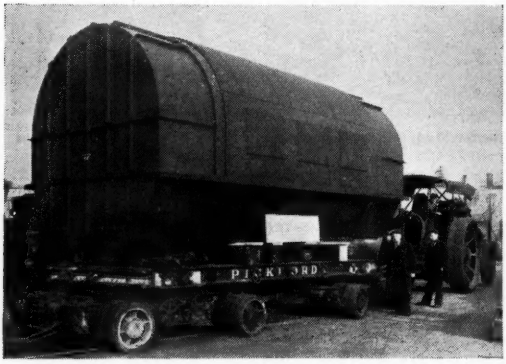
Dealing with the activities of the Federation, the president mentioned than a pensions scheme had been prepared for the staff. The method of electing the Grand Council and committees had been under review, and they hoped to submit proposals on this matter in the New Year.

Works Co-operation

An interesting new step has been taken in co-operation between management and shop representatives by the introduction of an output committee at the Heaton Works of C. A. Parsons & Co., Ltd. The committee meetings are held under the personal direction of Sir Claude Gibb, chairman and managing director of the company, and already many ideas which will help in the company's drive for increasing the output both for home and export trade have been put forward.

Transporting a 125-ton Stator

One of the largest electrical loads ever conveyed by road left the Stafford works of the English Electric Co., Ltd., recently. It comprised the 125-ton stator of a new 40,000-kW alternator to be installed by the company at the Blackburn Corporation's generating station. It required the services of one motor wagon and two steam traction engines in front, with an additional high-powered Diesel tractor behind for braking. Proceeding by day at an average of 5 m.p.h. the stator was estimated to have travelled an additional 100 miles in detours to avoid difficult bridges and junctions. With it was a staff of twelve drivers and mechanics who had their own mobile kitchen.



English Electric 125-ton stator on its way to Blackburn

Institute of Management

The President of the Board of Trade has appointed a committee under the chairmanship of Sir Clive Baillieu, president of the Federation of British Industries, to frame detailed proposals for the formation of a British Institute of Management. This follows the work of inquiry undertaken last year by a Board of Trade committee under Sir Cecil Weir's chairmanship when the idea of a British Institute of Management was discussed with representatives of industry and of existing institutions and associations interested in various aspects of management. Among the members of the committee are Miss Caroline Haslett, director, Electrical Association for Women; Sir Archibald McKinstry, deputy-chairman, Babcock & Wilcox, Ltd., and chairman, Industrial Management Research Association; and Mr. H. Towers, general manager, Edmundsons Electricity Corporation, Ltd. Lord Forrester, managing director, Enfield Cable Works, Ltd., has also been invited to serve on the committee.

Retail Businesses in Herne Bay

The Herne Bay Chamber of Commerce has pointed to the number of applications which are being granted for licences to open radio and electrical businesses in the town. It is felt that, with the return of traders who formerly carried on businesses of this nature, the town will be over-provided for and the Chamber suggests that the Local Price Regulation Committee should be asked seriously to consider whether it is desirable to grant any further licences for such businesses in Herne Bay. The General Purposes Committee of the Council has decided to inform the Local Price Regulation Committee that it concurs with the view expressed by the Chamber of Commerce.

X-ray Lecture Course

A course of lectures on X-rays will commence at the L.C.C. South-East London Technical Institute, Lewisham Way, S.E.4, on Friday, January 11th, 1946.

Aluminium Development

At a reception last week Air Commodore W. Helmore outlined the objects of the Aluminium Development Association (67, Brook Street, W.1). He said that the Association had been formed to provide a central body of design and development technicians representing the whole industry and maintained by its member firms, with the primary object of giving the user a better and cheaper article in aluminium and its alloys than could be obtained in any other material. Its functions were to initiate and produce aluminium prototypes and to evolve new uses and processes. Aluminium was now abundant. During the war the British and Empire output of raw aluminium and its alloys had increased nearly sevenfold with a comparable increase in the number of technicians and workers. Only by creating new designs and uses for aluminium could this vastly expanded industry be kept in being and its craftsmen maintained in employment.

The metal would make good many domestic equipment shortages and it had manifold applications in industry. It was, however, for all transportation purposes that aluminium and its alloys were ideally suited. All forms of road

vehicles were using more and more light metal and forward thinking railway engineers were already planning the revision of existing rolling stock in light metal. Shipbuilders were becoming " light metal minded " and, now that the corrosion bogey had been conquered, there were good grounds for the wide use of aluminium in ship construction.

Mica Freed from Control

By the Control of Mica (No. 5) (Revocation) Order, 1945 (S.R. & O. 1945 No. 1489) licences are no longer required for the acquisition, treatment, use or consumption of any categories of mica. Inquiries concerning this Order should be addressed to the Mica Control, Euston House, Eversholt Street, London, N.W.1.

Metal Cable Spools

The Control of Iron and Steel (No. 44) Order, 1945 (S.R. & O. 1945 No. 1425) removes the prohibition on the use of black plate, tinplate, and certain other materials in the manufacture of spools for electric cables.

Ministry of Fuel and Power

The Gas and Electricity Division of the Ministry of Fuel and Power is being removed from New Oxford House, Bloomsbury Way, London, W.C.1, to Cromwell House, Dean Stanley Street, Millbank, London, S.W.1. As from December 10th the telegraphic address will be " Minfupo, Souwest, London," and the telephone number Abbey 7000. The address for communications will be 7, Millbank, London, S.W.1.

Electrical Exhibitions

The " Electricity Looks Forward " Exhibition organised by North-Western Area of the Electrical Development Association, which is touring the Lancashire and Cheshire areas, is now being held in the Guild Hall, Preston. It will remain open until December 15th. Features of the exhibition are three model kitchens and equipment for farm and factory.

Blackburn Education Authority has arranged an electrical exhibition at the Technical College to stimulate interest in the industry.

Wages of Women Cable Workers

Increases in the wages of women and girl timeworkers and pieceworkers in Districts 1 and 2 are announced by the Joint Industrial Council for the Electrical Cable Making Industry. They are as follows:—Women, an increase of 3s. per 47-hour week; girls aged sixteen and seventeen, 2s. 3d.; girls aged fifteen and sixteen, 9d. The new rates take effect from the third pay-day in December.

Refrigerator for Every Home

Sir Ben Smith, Minister of Food, made a plea for a refrigerator in every home when he spoke at a luncheon of the Institite of Refrigeration last week. He said that in this country domestic refrigerators had been a rich man's luxury. He would like to see a much cheaper refrigerator that could be sold in vastly greater quantities. It would require no highly paid high-power salesman to create a market and a narrow profit on a big turnover would soon add up to more than the costly machines brought in.

Mr. Kenneth Lightfoot, president of the Institute, mentioned that refrigeration enabled the builders of operational aircraft to simulate in their factories stratosphere conditions so that the design and equipment of the plane could be tested in temperatures of minus 50 to 60 deg. F. He suggested that refrigeration in the form of air conditioning might solve the problem of shortage of seasoned timber by speeding up the process of seasoning.

Ferranti Radar Exhibition

As a result of the interest created by the Ferranti contribution to the radar exhibition held during Manchester's Thanksgiving Week Ferranti, Ltd. has now reopened an improved version of the exhibition at its Radio Works, Moston.

Scientific Civil Servants

The Civil Service Commission announces " competitions by interview " to fill vacancies in the scientific staffs of Government Departments. Between 300 and 500 scientific officers and senior scientific officers (21-30) are required. They must possess a university degree in a scientific subject or in mathematics with first or second class honours or an equivalent qualification. The salary scales for scientific officers are £275-£500 for men and £275-£430 for women, plus war bonus. There are from 750 to 1,000 vacancies for assistant experimental officers and experimental officers (18½-30) who are required to possess a university degree in a scientific subject or in mathematics, or a higher school certificate with mathematics or a scientific subject as a principal subject, or an equivalent qualification. The salary scales for assistant experimental officers are £150-£350 for men and £150-£280 for women, plus war bonus. Further details and application forms are available from the Civil Service Commission, Burlington Gardens, W.1.

Surplus Stores Disposal

An explanation of the methods being adopted by the Government in the disposal of surplus stores was given on Monday by Lieut.-General Sir Wilfred Lindsell, who has been appointed chairman of the Official Disposal Committee set up by the President of the Board of Trade to represent all Government Departments concerned. Sir Wilfred said that although there were vast quantities of surplus materials they were in the main not the consumer goods most in demand. Also much material was still required for the large armed forces still maintained.

In disposing of the goods the arrangements laid down in the White Paper (Government Surplus Stores, Plans for Disposal) would be followed to ensure fair distribution and to guard against hampering the reconstruction of industry by flooding the market with goods. Disposal was to be made normally by the Department responsible for providing the goods, through the ordinary trade channels. The Government reserved the right, however, to make other arrangements in cases of difficulty. The closest contact was to be kept with manufacturers and trade organisations with regard to

the necessity for exporting or otherwise. Reconditioning would be undertaken where necessary. The disposal linked up closely with the clearing of factory space for production work. About 150 million sq. ft. was at present required for storage purposes; it was hoped to clear nearly 36 million sq. ft. of this by the end of the year and all of it by the end of 1946.

I.M.E.A. Scottish Centre

Members of the Scottish Centre of the Incorporated Municipal Electrical Association were entertained to luncheon on Friday by Lord Provost Hector McNeill in Glasgow City Chambers to mark the jubilee of the founding of the Association. Paying tribute to the work accomplished by the Association, the Lord Provost said the members had conferred a signal honour on Alderman Sir William Walker of Manchester by making him their first "lay" president. Sir William, in reply, spoke of the rapid developments which had taken place in the electrical world; electricity now entered into practically every function of modern life. He paid a tribute to the services rendered by Scottish representatives to the Association.

Steel-glass Windows

The recent development of a group of glasses that can be sealed to iron and hermetically into a frame of ordinary mild steel is announced in *B.T.H. Activities*, which describes a "Windonut" made in this way to serve as an oil-level indicator for geared motors. A thick disc of glass is cast and pressed into a hollow hexagon-headed screw of copper-clad mild steel while the metal is at red heat so that the glass is united to the metal by fusion. The outer glass face is somewhat larger in diameter than the inner, to enlarge the viewing angle. The steel projects to form a protective "eyebrow" around the "window," which is screwed by means of an ordinary spanner into a tapped hole and made oil or gas tight by normal pipe-jointing methods. Various sizes and shapes have been produced, some with prisms cast integrally with the window.

South Fremantle Contracts

It is reported in *Tenders* (Australia) that contracts totalling over £270,000 have been placed by the Western Australian Government for switchgear for the South Fremantle power station. They are as follows:—66-kV outdoor, 20-kV indoor and 6·3-kV switchgear: Metropolitan-Vickers (£220,122). 3-kV switchgear: Ferguson Pailin (£27,290); Australian General Electric (£A17,470); and British Thomson-Houston Pty. (£6,946).

Spanish Electrical Industry

Increased demand coupled with the difficulties of importing goods from abroad during the war period has favoured the development of Spanish industries supplying electrical machinery and appliances. To-day there are approximately 220 factories producing electrical equipment, their aggregate capital being about 500 million pesetas. Production of motors has risen from 83,518 HP in 1935 to 191,736 HP at the present time, and the output of transformers from 140,433 kW to 337,941 kW. Nevertheless, reflecting the great increase in demand, imports of electrical equipment rose from 8,600,000 gold pesetas in 1940 and 1941 to 28,800,000 in 1943. In 1944, however, imports fell to 22,300,000 gold pesetas due to wartime conditions, 8,000,000 pesetas worth of this total being supplied by Switzerland.—*Reuter*.

Fluorescent Lamp Development

A lecture and demonstration on "The Development of Fluorescent Lamps" was held at Paisley by the local Association of Electrical Engineers. Mr. E. D. Jones, B.Sc., who was assisted by Mr. H. L. Privett of the B.T.H. Research Laboratories, was the principal speaker. Mr. Daniel Ross, A.M.I.E.E., president, was in the chair.

Change of Name

The name of the Ilford Electrical Co., Ltd., has been changed to I. E. Co., Ltd.

Trade Announcements

Delco-Remy & Hyatt, Ltd., are moving back their administrative, sales and accounting offices on December 17th to 111, Grosvenor Road, London, S.W.1 (telephone: Victoria 6242).

J. Sfinton Jones & Partners, have moved to 21, Gloucester Place, London, W.1 (telephone: Welbeck 2923).

TRADE MARKS

RECENT applications for the registration of trade marks include the following, objections against which may be entered within a month of November 28th :—

ELECTRICON. No. 635,488, Class 9. Electrical apparatus and instruments not included in other classes; electrical scientific and electrical signalling apparatus and instruments; television apparatus and instruments; and parts of all such goods not included in other classes.—Ronald Trist & Co., Ltd., Bath Road, Slough.

LOBLITE. No. 636,039, Class 9. Electrical apparatus, instruments and appliances, none being included in other classes.—Loblite, Ltd., Engineering Works, Third Avenue, Team Valley, Gateshead-on-Tyne.

R.E.A.L. No. 631,360, Class 11. Electric lighting apparatus and fittings, electric fires, and parts (not included in other classes) of all such goods.—Rowlands Electrical Accessories, Ltd., R.E.A.L. Works, Hockley Hill, Birmingham.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

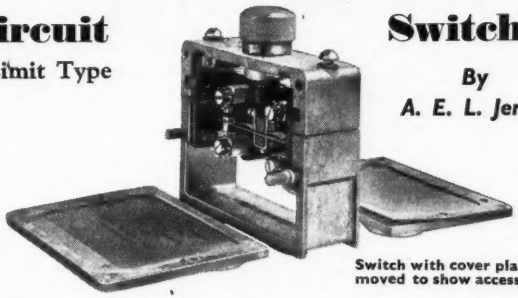
Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information about the following:—

Makers of "PRIMA" six point inspection lamps.

Control Circuit Switches

"Snap-Action" Limit Type

By A. E. L. Jervis



Switch with cover plates removed to show accessibility

AMONG control switches of improved design developed by Brookhirst Switchgear, Ltd., is a snap-action type for push-button operation in a similar manner to the block type described in the *Electrical Review* of May 25th, 1945, but the contacts and internal operating mechanism are quite different since the moving blade is actuated by two flat springs, each anchored at one end to the push mechanism. The action is definite, it being impossible to hold the switch in a mid position. The moving contact has a long life because it does not remain rigid, but is arranged to flex in a similar manner to the actuating springs.

The main frame and front and back covers are die-cast. One of the features of the main frame is that it lends itself to building-up into a multiple unit. The back cover is removable in exactly the same manner as the front cover; both are identical, as will be seen from the heading illustration, and their removal exposes the fixed and moving contact assemblies to view. The frame is "split" in such a way that the top portion, complete with both fixed and moving contacts, can be removed to render all terminals readily accessible for cabling.

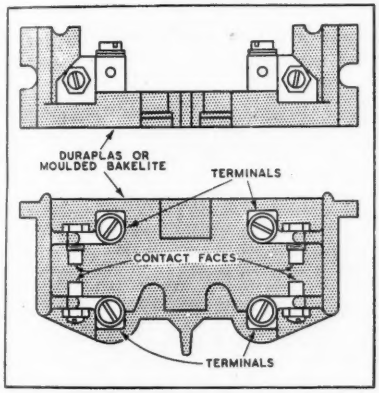


Fig. 1.—Arrangement of fixed contacts of switch on plastic base

The fixed contact assembly (fig. 1) comprises four sub-assemblies mounted on a common base of plastic material. The actual contacting surfaces are four studs with silver tips. The moving arm is of beryllium copper and each end is fitted with top and bottom tips of solid silver. The moving arm is not directly connected to the push mechanism of the switch, but is actuated by two flat springs anchored to the moving stirrup. Fig. 2a shows the appearance of the moving contact assembly when the switch is at rest. When the button is pushed, the actuating springs are increasingly flexed (fig. 2b) and then, when a given point is reached, the moving contact arm is flicked over from position "X" to position "Y" as shown in fig. 2c. The action is very definite and takes place in a fraction of a second. The contact pressure is increased up to the moment of change over.

The following range is available: 550 V AC, 10 A; 220 V DC, 0·5 A; 440 V DC, 0·25 A; and 550 V DC, 0·2 A. The switch can be used to break a circuit which is normally closed, to make a circuit which is normally open, or to change over from one pair of fixed contacts to another. A load of 3·5 lb. on the pushbutton is needed to work the switch, which can be directly operated by pushbutton action, or by means of the roller and lever.

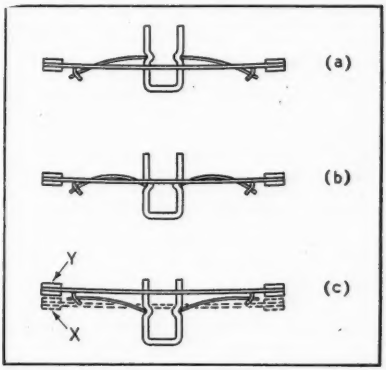


Fig. 2.—Action of moving contacts

Forthcoming Events

Saturday, December 8th. — *London.* — Porchester Hall, Bayswater, 7 p.m. I.E.E. London Students' Section and I.Mech.E. Graduates' Section. Joint dance.

Glasgow.—Royal Technical College, 3 p.m. Association of Mining Electrical and Mechanical Engineers, West of Scotland Branch. "Electricity as Applied to Mining," by A. Hall.

Monday, December 10th. — *Birmingham.* — Colmore Room, Grand Hotel, 7 p.m. Midland Technical Group E.P.E.A. "A Standardised Range of AC Substations," by J. L. Ferns and L. Heaton.

Cardiff.—South Wales Institute of Engineers, 4.45 p.m. I.E.E. Western Centre. Repetition of presidential address by Dr. P. Dunsheath.

Newcastle-on-Tyne.—Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North-Eastern Centre. "Factors Influencing the Design of Electric Lighting Installations for Building Interiors," by R. O. Ackerley.

Leeds.—Electricity Showrooms, The Headrow, 6 p.m. Illuminating Engineering Society. "Street Lighting," by N. Schofield.

Tuesday, December 11th.—*London.*—Institution of Chemical Engineers, 5.30 p.m. "Electrical Engineering in the Manufacture of Electric Lamps and Radio Valves," by F. W. Doxey.

Belfast.—Queen's University, 6.45 p.m. I.E.E. Northern Ireland Centre. "Excess-Current Protection of Over-current Relays on Medium Voltage Circuits," by A. G. Shreve and P. J. Shipton.

Edinburgh. — Heriot-Watt College, 7 p.m. British Institution of Radio Engineers, Scottish Section. "Ultra-High Frequency Techniques," by Professor M. G. Say.

Manchester.—Engineers' Club, 6 p.m. I.E.E. North-Western Centre Installations Group. "Excess Current Protection by H.R.C. Fuses on Medium Voltage Circuits," by R. T. Lythall.

Wednesday, December 12th.—*London.*—Institution of Electrical Engineers, 5.30 p.m. I.E.E. Transmission Section. "Mechanical Stresses in Transformer Windings," by E. Billig.

Edinburgh.—Heriot-Watt College, 6 p.m. I.E.E. Scottish Centre. "The Place of Radiant Dielectric and Eddy Current Heating in the Process Heating Field," by L. J. C. Connell, Q. W. Humphreys and J. L. Rycroft.

Ipswich. — Institute of Welding, Eastern Counties Branch. "Electric Stud Welding and Welding Transformers," by A. H. Bent.

Sheffield.—Central Library, 7.15 p.m. I.E.E. Sheffield Sub-centre, joint meeting with the Sheffield Society of Engineers and Metallurgists. "Crystallographic X-ray Investigation of Electro-metallurgical Problems," by Dr. A. H. Kay.

Thursday, December 13th.—*London.*—Institution of Electrical Engineers, 5.30 p.m. I.E.E. Installations Section. "Mineral-insulated Metal-sheathed Conductors," by F. W. Tomlinson and H. M. Wright.

Alliance Hall, Palmer Street, S.W.1, 2.30 p.m. Diesel Engine Users' Association. Annual general meeting.

Swansea. — I.E.E. West Wales Sub-centre. As for Newcastle-on-Tyne, December 10th.

Bradford.—Electricity Showrooms, Sunbridge Road, 6.45 p.m. Illuminating Engineering Society. "Fluorescent Lighting," by J. K. Frisby.

Friday, December 14th. — *London.* — Institution of Electrical Engineers, 5.30 p.m. Measurements Section. "A Precision AC/DC Comparator for Power and Voltage Measurement," by G. F. Shotter and H. D. Hawkes.

St. Stephen's Tavern, Bridge Street, Westminster, 6.30 p.m. E.P.E.A. Meter Engineers' Group (Southern Division). Annual general meeting.

Nottingham.—Nottingham Society of Engineers. Annual dinner.

Birmingham.—Imperial Hotel, Temple Street, 6 p.m. Illuminating Engineering Society (Birmingham Centre). "Mercury Vapour Projector Lamps," by H. K. Bourne.

Saturday, December 15th.—*Manchester.*—At College of Technology, Sackville Street. Manchester Association of Engineers. Conversazione and dance (tickets 7s. 6d.).

Leeds.—Electricity Offices, Whitehall Road, 2.30 p.m. I.E.E. North Midland Students' Section. "Power Transformer Maintenance," by A. E. Shearer.

Monday, December 17th. — *Birmingham.*—Grand Hotel, 6 p.m. Birmingham Electric Club. "Electrical Plant Breakdowns," by J. Ashmore.

Appliance Maintenance

THERE is likely to be a widespread use of improved types of domestic appliances of all kinds in the near future. Will public utility undertakings be expected to service appliances which have not been chosen or installed by them? Electricity and gas undertakings will look askance if asked to do so while the coal industry has no organisation for the purpose as appliances are usually landlords' fittings.

In a paper submitted to the Institute of Fuel in London MR. O. W. ROSKILL (who concerns himself more particularly with the solid fuel aspect of the subject) points out that in the past a large proportion of gas and electrical appliances have been sold, or hired, through utility undertakings. The latter not only purchased the greater part of manufacturers' output, but have also been responsible for installation and servicing; so they have in many cases exercised a considerable influence on design, based on maintenance experience. Solid fuel appliances have been sold through builders' merchants and repaired by builders, but a big change seems likely to take place soon.

Co-ordination is needed; a servicing organisation should also assume general responsibility for installation, so as to make supervision and servicing easier. But the author does not believe that this need inevitably involve ownership and control by a single organisation. If service is to be rendered regularly, whether the consumer asks for it or not, its cost must logically be included in the price of the appliance or that of the fuel.

ELECTRICITY SUPPLY

Battersea Extension. Glasgow Trolley-Bus Trial.

Ashbourne.—ELECTRICITY FOR HOUSING ESTATES.—Application is to be made by the Electricity Committee for sanction to loans of £2,710 and £433 for mains and services for the Park housing estate.

Bangor (North Wales).—CONTROL OF PEAK LOADS.—The borough electrical engineer (Mr. F. C. Harber) has reported to his committee that he has under consideration the installation of equipment for the control of consumers' apparatus to reduce the peak loads and consequently the charges of the North Wales Power Co.

Bedford.—RURAL SUPPLIES.—The Electricity Committee is to provide supply to a number of isolated farms and other premises at Cople, Northill, Willington, Mogerhanger, Beeston and Kempston at a cost of £3,550.

Brierley Hill.—STREET LIGHTING.—The Urban District Council is to install twenty-two new sodium lamps and remove eight existing lamps to new positions.

Brighouse. — SUBSTATIONS. — The Electricity Committee is to erect substations at Granny Hall Lane and Toothill Lane, Rastrick.

SUPPLY TO HOUSES.—Supplying electricity to temporary housing sites at Whinney Hill and Crowtrees Lane will cost £1,100.

APPLICATION FROM FACTORY.—Henry Healey (Wire Products), Ltd., has asked for a supply of electricity to Livingstone Mills.

Burnley.—HIRE-PURCHASE FACILITIES.—The Corporation Electricity Committee has passed a resolution favouring the resumption of hire-purchase facilities for consumers and is to discuss future policy and practice with the Gas Committee. To finance hire-purchase schemes consent is being sought to loans of £3,536 and £6,597 for wiring installations and the provision of consumers' apparatus and £2,000 for the provision of cookers.

London.—J.E.A.'s ESTIMATES.—The Finance Committee of the London & Home Counties Joint Electricity Authority has submitted estimates for the year ending March 31st, 1946. These show a probable income of £1,615,080 (against £1,558,150 estimated for 1944-45), with working expenses amounting to £1,230,140 (£1,130,730). Total sales are put at 213·1 million kWh (201·0 million) so that income per kWh sold would be equal to 1·82d. (1·86d.) and working costs 1·39d. (1·35d.). The total number of consumers is given as 144,700 (142,900).

BATTERSEA EXTENSION.—The Technical Committee of the London and Home Counties J.E.A. reports the receipt of a copy of the London Power Company's application to the Electricity Commissioners for consent to extend the Battersea generating station, under a C.E.B. direction. It is proposed to install one 50,000-kW (m.c.r.) turbo-alternator set, one 5,000-kW house service set and three e.h.p. boiler units. Together with the necessary building and civil engineering works the estimated cost is £3,372,436, or approximately £50 per kW.

Mansfield.—CONSUMER'S SERVICE UNIT.—At the suggestion of the borough electrical engineer the Housing Committee has decided to adopt a service unit of the type in which the whole of the consumer's fuses are housed in a single component (a prototype sample was laid before the Committee) for the electrical installations in Council houses now being built.

EXTENSIONS.—The Electricity Committee is to extend the 11-kV system to Bull Farm & Pleasley (£12,144); provide supplies to the Bancroft housing estate (£5,057), to 56 houses on the Racecourse estate (£486), to Station Street (£1,040) and Low Oakham Farm (£410); and lay mains to the Mansfield Woodhouse estate (£618).

Melton Mowbray.—STREET LIGHTING.—The Urban District Council proposes to erect additional street lamps.

Meriden.—STREET LIGHTING.—Owing to the proposed nationalisation of coal mines the Arley Colliery Co. has informed the Rural District Council that it is unable to enter into a long-term agreement for street lighting in Arley. The Council has therefore agreed to accept proposals put forward by the Leicestershire & Warwickshire Electric Power Co. With regard to street lighting in part of Keresley, the Council has agreed, following an interview with the managing director of the Warwickshire Coal Co., that the most desirable course is for the system to be taken over by the Coventry Corporation Electricity Department, and negotiations have been commenced with the Corporation.

Northern Ireland.—BORROWING POWERS.—Moving the second reading of the Electricity (Supply) Bill which increases the existing borrowing powers of the Electricity Supply Board by £300,000, Major Perceval-Maxwell, Parliamentary Secretary, Ministry of Commerce, said it was the desire of the Government of Northern Ireland to see further developments conducted with speed and efficiency, so as to ensure that the trade and industry of the country would be expanded and that every farmer would be able to have electricity.

Poplar.—ELECTRICAL INSTALLATIONS.—In his annual review the Mayor of Poplar referred to the acceptance by many authorities of the principle that electrical apparatus should be considered in the design and in the building of new property. The industry, he said, had always been handicapped because domestic apparatus had to be installed after occupation and not, as it should be, before completion. That meant that no longer would the tenant have to bear additional expenditure after moving in, for the whole of the costs of such apparatus would be included in the value of the house. The effect would be to reduce costs and bring the benefits of electricity to many thousands who previously were unable to afford what were then looked upon as luxuries.

"ALL-ELECTRIC" HOUSES.—The Housing Committee recommends that emergency houses shall be served exclusively by electricity.

REDUCING PEAK-LOAD CONSUMPTION.—In order to avoid the necessity for carrying out any form of "load shedding," with its resultant inconvenience to consumers, the borough electrical engineer has circularised all industrial consumers asking for their collaboration in this matter by reducing their consumption at peak load periods (11 a.m. to noon and 4 p.m. to 5 p.m.) and also during foggy weather. Already a considerable number of promises have been received.

Scotland.—NORTH-WEST ROSS-SHIRE SCHEME.—The North of Scotland Hydro-Electric Board has been informed by the Electricity Commissioners that they have now approved the technical and financial details of the Board's Distribution Scheme for Gairloch and Aultbea in North-West Ross-shire. This is the Board's Third Distribution Scheme; it will now be submitted to the Secretary of State for confirmation and will shortly be published.

ACQUISITION OF R.A.F. PLANT.—In January last the Board began a survey of the island of Islay. This showed that generating plant at the R.A.F. station at Bowmore might prove suitable for temporary use in providing supplies in the early stages of a distribution scheme for the island. The Air Ministry was approached, and agreement has now been reached for the Board to purchase the whole of the Bowmore plant. A scheme for local distribution has already been prepared. Ultimately this will become part of a wider scheme covering most of the island. Subject to availability of labour and materials, it is hoped to start erection of the distribution lines early next year.

Stalybridge.—PROVISION OF SERVICES.—The Stalybridge, Hyde, Mossley and Dukinfield Transport and Electricity Board has approved a proposal of the engineer (Mr. J. H. Lumsden) that no charge shall be made for services where the wiring installation includes provision for cooker, water heater and wash boiler, together with socket outlets as scheduled in the "Housing Manual."

Wigan.—SUPPLY EXTENSION.—The Lancashire Electric Power Co. has informed the R.D.C. that approval has now been obtained to the extension of the company's supply to the Elmers Green and Back Lane areas at Dalton, and the work is to be carried out as soon as possible.

York.—TENANTS TO CHOOSE.—At a meeting of the Corporation Housing Committee representatives of the York, Harrogate and District group of gas companies and the city electrical engineer attended to discuss the supply of gas and electricity to Council houses. The Committee considered proposals by both parties and decided that in the interests of the tenants the houses should be fitted for both gas and electricity services and that the tenants should be given the opportunity of choosing which they preferred.

Overseas

China.—CONTROLLING THE YANGTSE RIVER.—Mr. Harold Ickes, U.S. Secretary of the Interior, announcing the signing of a contract to assist the Chinese Government in working out a comprehensive development programme in the Yangtse River basin, said that engineers of the U.S. Bureau of Reclamation would prepare designs and specifications for what might be the largest concrete dam ever built. The dam would be built near Ichang, in the heart of China, and behind it the river would form a reservoir 250 miles long. The plans also call for the construction of numerous other dams, hundreds of miles of irrigation canals, and a large hydro-electric scheme.

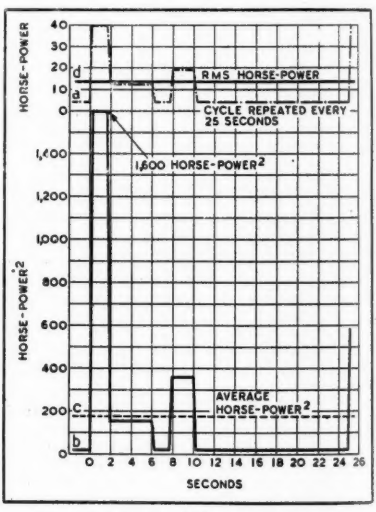
TRANSPORT

Glasgow.—EXPERIMENTAL TROLLEY-BUS SERVICE.—The Corporation Transport Committee has approved in principle the carrying out of an experiment with trolley-buses at an estimated cost of £126,000 (25 vehicles £75,000, overhead equipment £12,000, two substations £5,000, cables £34,000) and the manager is to report on the technical aspects and steps to be taken to obtain tenders.

Newcastle-upon-Tyne.—TROLLEY-BUS BILLS.—A Select Committee of the House of Lords presided over by Lord Rushcliffe has intimated that the Bill by which the Corporation seeks to obtain powers to convert all of the remaining tramway system to trolley-bus services should be allowed to proceed, subject to two minor alterations. The proposals are being strongly opposed by the United Automobile Bus Co., the Tyneside Tramway Co. and the Gateshead Tramway Co.

Induction Motor Capacity

IN the article under the above heading published in the *Electrical Review* of November 30th reference was made to Fig. 1, which was unfortunately omitted. The diagram, illustrating the graphical determination of RMS horse-power, is reproduced herewith.



Determination of RMS horse-power

PARLIAMENTARY NEWS

By our Special Reporter

Electrically-Propelled Bicycles

DURING the Committee stage of the Finance Bill in the House of Commons Lord Hinchingbrooke asked for an explanation of Clause 4 (amendment as to rate of excise duty on electrically-propelled bicycles).

Mr. Barnes, the Minister of War Transport, said that the point raised in the clause was really very simple. Owing to a shortage of motor spirit during the war, a certain number of bicycles were converted to electrical propulsion. The range was very limited. There was no evidence that they would increase to any extent. The duty that had been charged had been on the lowest rate, 17s. 6d., and this clause regularised a practice which had been in operation since this type of vehicle came on the market.

Mr. C. Williams asked for the approximate number of bicycles taxed and the amount collected by the tax. He protested that a lot of people who should not have been taxed at all had been illegally taxed.

Mr. Barnes said he could not agree for one moment that any of these people had been illegally taxed. The bicycle was subject in the first place to the tax of 17s. 6d. It was converted to electrical propulsion and there had been no increase in the tax. Under previous Finance Bills there was no provision for this tax to be levied on this type of bicycle. Therefore the practice of the trade in regard to that type of vehicle was followed. This proposal merely legalised what had been in operation during the war. He had not the number, but it was not very large, probably not more than the number of motor cars which had gas bags put on the top of them.

The clause was agreed to.

Utility Wireless Sets

On November 26th, Colonel Erroll asked the President of the Board of Trade, if he would state the names of the principal firms engaged in the manufacture of adaptors for utility wireless sets, together with estimates of their expected weekly output on January 1st, 1946.

Sir Stafford Cripps said that the Radio Industry Council had recommended that the manufacturers of the wartime civilian receivers should modify those receivers where necessary. There should be no difficulty for those who wanted their sets modified to get this done through retailers. A separate adaptor unit was being produced by one firm.

Coal Stocks

On November 27th, Mr. Raikes asked the Minister of Fuel and Power what were the stocks of coal at gas and electricity works in England and Wales on November 1st, 1943, 1944 and 1945, respectively.

Mr. Shinwell said that the stocks of coal in England and Wales at the nearest convenient date to November 1st in the three years referred to were as follows:—October 29th, 1943: Gas, 2,397,879 tons; electricity 3,860,861 tons. October 27th, 1944: Gas, 2,716,168 tons; electricity, 3,586,126 tons. October 26th, 1945: Gas, 1,657,110 tons; electricity 3,206,694 tons.

Electricity in Scotland

Mr. MacMillan asked the Secretary of State for Scotland what specific schemes for hydro-electric development in each of the islands of the Outer Hebrides had been prepared.

Mr. Buchanan, replied that the North of Scotland Hydro-Electric Board had surveyed, and prepared schemes for the distribution of electricity in Lewis, Harris, North Uist, Benbecula, South Uist, Eriskay and Barra. In Lewis and Harris five water-power projects had been surveyed, but some technical, economic and fishing difficulties remain to be overcome. In the other islands, there was very little water power available and some of the necessary power production might be from oil engines.

Mr. Henderson Stewart asked the Secretary of State for Scotland whether in view of the criticisms made of the Tummel-Garry scheme, whether he would now adopt the suggestion made during the Committee stage of the 1943 Bill, that the Hydro-Electric Board should be required to prepare a series of projects in the next scheme presented to Parliament, covering, say, a five- or seven-year period of operations, so that Parliament and the country might be able to balance one project against another and regard the operations of the Board over a wide area instead of any single limited area.

Mr. Buchanan, said that particulars of the projects which the Board had under consideration had been given in an earlier reply. Legislation would be required to give effect to the suggestion, which was considered and rejected when the Hydro-Electric Development (Scotland) Bill was before Parliament in 1943. He (Mr. Buchanan) did not think that it would, in any case, be appropriate or convenient to include in a single constructional scheme a series of major projects which might raise quite dissimilar issues.

Air Ministry Plants in Hebrides

Mr. M. MacMillan, asked the Under-Secretary of State for Air whether he would give an assurance that Air Ministry electricity generating plants and the buildings in the Outer Hebrides would not be dismantled or

disposed of until they had been made available for use on the spot to the local authorities or the North of Scotland Hydro-Electric Board for extending light and power through neighbouring districts. Mr. Strachey replied in the affirmative.

Tummel-Garry Scheme

On Monday in the House of Lords the debate on the Tummel-Garry scheme (see our last issue) was resumed on a motion by Lord Kinnaird who moved that "papers be laid before the House" relating to the operation of the Hydro-Electric (Scotland) Act, 1943. The motion, which was virtually one for the rejection of the Tummel-Garry scheme, was negatived without a division.

Building Materials Bill

On the Committee stage of the Building Materials and Housing Bill on Monday last Mr. Manningham-Buller unsuccessfully moved an amendment to limit bulk purchases to overseas requirements and materials needed for permanent pre-fabricated houses.

The Minister of Works (Mr. Tomlinson) moved an amendment extending the period for the advance of sums to the Minister of Works from the fund to be set up from 1947 to 1950. This was agreed to.

Mr. Willink moved an amendment to provide that the Minister of Works should not arrange for the production or distribution of equipment unless the existing means were found to be inadequate. This was rejected.

A further amendment put forward by Mr. Manningham-Buller to require that accounts of the fund should be of a detailed character was rejected after some debate in which the Minister of Health (Mr. Aneurin Bevan) participated.

Terms of Agreement

Mr. De La Bere asked the Minister of Fuel and Power whether in view of the fact that certain electricity undertakings in this country were inserting a clause in their forms of agreement for the supply of electricity to the effect that the company should be entitled to terminate the terms and conditions under which the supply of electricity was provided and taken upon giving seven days' notice to the consumer, he would introduce legislation to render such stipulations and conditions illegal, especially having regard to the interests of men released from the Forces who lived in the rural areas.

Mr. Shinwell said that the clause referred to was intended to enable the electricity supply undertaking to vary the terms and conditions, such as charges for electricity, at seven days' notice, but not to terminate the supply. The clause did not seem to him to be unreasonable.

I.M.E.A. Notes

Motor Starting.—A committee consisting of representatives of the British Electrical and Allied Manufacturers' Association and the Incorporated Municipal Electrical Association has been set up to consider the revision of a booklet issued by B.E.A.M.A. in 1938 embodying recommendations regarding the starting of AC motors on public supply mains. The *I.M.E.A. Journal* says that S.R. & O. 1941 No. 1864 is about to be withdrawn except for the provisions that motors up to 5 BHP shall be direct-on started and that machines up to 30 BHP shall be of the squirrel-cage type.

War Damage.—Discussions between the Electricity Commissioners and representatives of the electricity supply associations have resulted in the setting-up of a committee to advise the Commissioners and the associations regarding various matters connected with the proposed Bill dealing with the payment of war damage compensation to public utility undertakings. It has been agreed that the contribution by the Treasury will be not less than 50 per cent. of the total claims and that all public utility groups will be treated alike.

Meter Certification.—At a recent meeting the Electricity Commissioners sought the views of the electricity supply associations on two questions relating to the resumption of meter certification. The first was whether individual certification fees should be charged or whether the expenses should be recovered through the Commissioners' levy; the second was whether Defence Regulation No. 60CB, which suspended certification, should be amended to enable undertakers to resume certification on a voluntary basis, when they were in a position to do so, before the suspension was removed.

The I.M.E.A. favoured revision of the present practice so that expenses would be recovered through the Commissioners' levy, but the other associations were in favour of the present procedure. The Commissioners decided that as amending legislation would be necessary and there was a large majority against the revision proposal the matter would be dropped. The *I.M.E.A. Journal*, referring to the Commissioners' use of the term "large majority," points out that "the I.M.E.A. represents over 60 per cent. of the supply of electricity in Great Britain."

The Commissioners pointed out the difficulties in the way of the resumption of meter certification and, with the agreement of those present, considered that Regulation 60CB should be retained and amended to enable undertakers to recommence certification on a permissive basis when they were able to do so. Consideration is to be given to the extension of the ten-year period under the 1926 Meters Act; the Commissioners suggested extension to 1950 but the majority of the representatives pressed for a longer extension.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

Falk, Stadelmann & Co., Ltd., held their annual meeting last week, Mr. Gustav Falk (chairman and joint managing director) presiding. In his statement circulated with the report and accounts the chairman first referred to the loss which the board had sustained by the death, on September 9th last, of the former chairman, Mr. Max Falk, who had been connected with the company for more than half a century.

Turning to the company's activities during the year, the chairman said that at the commencement all its factories were placed at the disposal of the Government. Those at Birmingham, Rainhill (Lancs), Banbury and London were greatly extended in scope and produced large quantities of war materials covering a great variety of essential components. In addition the company was able to maintain the output of reasonable quantities of its normal products. Attention was now being directed towards the manufacture and development of lighting, heating and cooking appliances, besides the production of equipment for Government-sponsored housing schemes; export trade was being given high priority. In 1940, 1941 and 1944 several of the properties of the company in London and Birmingham suffered severe damage through enemy action. Steps had been taken to reinstate partially some of these damaged buildings, which would assist the company in dealing with the increased demand for its products.

Peto Scott Electrical Instruments, Ltd.—With the accounts for the year ended March 31st last (a summary of which appeared in our issue of November 16th) is circulated an announcement of an extraordinary general meeting to be held after the annual meeting to-day (Friday). A resolution is to be submitted authorising the company to acquire for £35,500 the entire ordinary share capital of Thorpe & Thorpe, Ltd., electrical engineers and contractors. To finance the acquisition it is proposed to offer a further 152,440 Peto Scott ordinary shares of 2s. each at the price of 4s. a share in the proportion of one new share for every two Peto Scott shares held. The remainder of the sum required will be provided from surplus cash resources.

Electric & Musical Industries, Ltd.—For the year ended June 30th last the consolidated statement shows a profit (after providing for depreciation and obsolescence and adding interest from Government securities) of £1,348,685, compared with £1,139,311 in the previous year. Taxation paid and accrued absorbs £706,207 (£572,013), reserve for 1946-47 income tax receives £337,637 (£323,254), directors' fees take £4,349 (£5,893), £50,000 (nil) is written off patent rights acquired, and £64,790 (£56,127) is allocated for staff pensions, leaving a net group profit of £185,702 (£182,024). The net profit of the parent company was £150,085 (£149,250). The preference dividend absorbs £15,525 (£13,800) and after again paying an ordinary dividend of 6 per cent. plus a bonus of 2 per cent. less tax at 9s. 9d. (8s. 9d.), a sum of £268,902 (£253,360) is carried forward.

The chairman, Mr. Alfred Clark, states that owing to the company's pre-war research work there was already in existence at the outbreak of war a unique team of scientists with the necessary facilities, which proved to be a national asset. The reversion to peace-time production cannot rapidly be achieved and the financial burden of transition will be heavy, especially as the Ministries involved have so far been unable to grant any allowance to cover the necessary re-establishment of the works. During the year the company acquired a group of patents relating to a new application of science and engineering. This is a system closely allied to some branches of the company's work and one which it hopes to develop for the British market.

Crompton Parkinson, Ltd., report a profit of £434,283 for the year ended September 30th last (against £432,099). It is recommended that £5,000 (same) be transferred to the central benevolent fund. Final dividends of 7½ per cent. are declared on the ordinary and "A" ordinary stock, again making 15 per cent. for the year, and a special cash bonus of 7½ per cent. for both classes is again to be paid. The amount carried forward is increased from £588,256 to £690,039.

The British Electric Transformer Co., Ltd., announces a profit of £29,674 for the past year (against £24,569). A final dividend of 10 per cent. makes the distribution for the year 20 per cent., as compared with 15 per cent.

The Associated Equipment Co., Ltd., reports a profit for the year to September 30th last of £1,083,500 (against £1,063,000) after allowing £100,000 (same) for depreciation and replacement reserve. Allocations are £865,000 (£835,500) for taxation provision, £48,000 (£50,000) for additional depreciation and replacement reserve, £15,000 (£25,000) for deferred maintenance reserve, £20,000 (same) for employees' benefit reserve and £21,000 (£20,000) for general reserve. The dividend for the year is maintained at 7½ per cent. free of tax, and £2,000 (nil) is left which increases the unappropriated balance to £270,000.

D. Napier & Son, Ltd., which is controlled by the English Electric Co., Ltd., reports a profit for the year to September 30th last of £101,382 (against £85,588) after taxation and £31,764 (£88,038) for depreciation. The ordinary dividend is unchanged at 7½ per cent. and £340,438 (£278,061) is carried forward. The sale of certain fixed assets to the Minister of Aircraft Production, under arrangements made in November, 1942, was completed during the year.

The Sun Electrical Co., Ltd., proposes to pay a dividend of 2½ per cent. (same) for the year ended April 30th last, the net profit for the period being £18,915 (against £17,856).

Joseph Lucas, Ltd., report a profit of £319,270 (against £289,426) for the year to August 7th

last. The dividend on the ordinary shares is maintained at 15 per cent. by a final payment of 12½ per cent.

Edmundsons Electricity Corporation, Ltd., is again paying an interim ordinary dividend of 2½ per cent.

Thomas de la Rue & Co., Ltd., announce an interim ordinary dividend of 10 per cent., the same as last year.

Marco Refrigerators, Ltd., is paying a first and final dividend of 5 per cent. (against 2½ per cent.).

Cape Electric Tramways, Ltd.—A preliminary statement for the year to June 30th shows a net profit of £55,209 (against £47,809). The dividend is again 6 per cent. and after transferring £20,000 (same) to replacements reserve £67,505 (£61,769) is carried forward.

John I. Thornycroft & Co., Ltd., propose to pay a final dividend of 12½ per cent., making 17½ per cent. for the year ended July 31st last (against 13 per cent.). The net profit, after taxation, was £127,989 (£128,685).

Telephone Properties, Ltd.—A first and final dividend of 6 per cent. is being paid on the ordinary stock for 1944 (same). The net profit for the year was £29,322 (against £30,968).

British Rola, Ltd., has declared a first and final dividend of 15 per cent. (same) for the year ended March 31st last. The trading profit was £66,463 (£54,714).

The Electric & General Investment Co., Ltd., has declared an interim dividend of 3 per cent. (same), less tax at 9s. 6d.

W. & T. Avery, Ltd., have declared an unchanged interim dividend of 5 per cent.

Hick, Hargreaves & Co., Ltd., announce an interim dividend of 2 per cent. (same).

New Companies

Howdenshire Electrical Contractors, Ltd.—Private company. Registered November 27th. Capital, £1,000. Objects: To carry on the business of electrical contractors, manufacturers, fitters, installers and maintainers and repairers of, and dealers in, radio, television and telecommunication requisites and supplies, etc. Permanent directors: J. K. Ransome, Elloughton, Brough, East Yorks, and W. P. Conyers, 230, Pickering Road, Hull, director of St. Dunstans Fishing Co., Ltd. Registered office: Main Street, Elloughton, Yorks.

Industrial Infra Red, Ltd.—Private company. Registered November 26th. Capital, £1,000. Objects: To carry on the business of electrical, heating, lighting, ventilating, telephone, radio, mechanical and general engineers, manufacturers, fitters, installers, maintainers and repairers of, and dealers in, infra-red heating and drying apparatus and equipment, and electrical and mechanical apparatus, etc. Directors: H. Sherratt, 84, Moss Park Road, Stretford, Manchester, and S. Glithero, 105, Rowson Road, Hyde, Cheshire. Registered office: 30, Brown Street, Manchester, 2.

Glossop, Simmonds & Co., Ltd.—Private company. Registered November 26th. Capital, £500. Objects: To carry on the business of manufacturers of, and dealers in, dynamos, motors, armatures, wireless requisites, cookers electrical plant, etc. Directors: H. A. J. Glossop, 134, Seymour Avenue, Morden, and three others. Registered office: 300, High Street, Sutton.

P.A.R., Ltd.—Private company. Registered November 7th. Capital, £5,000. Objects: To carry on the business of manufacturers, factors, maintainers and repairers of, and dealers in, inter-telecommunication, telephone and radio apparatus and supplies of all kinds and acoustical equipment, etc. Subscribers: H. R. Johnson, 456 Newark Road Lincoln, and T. Cooke, 167, Rutland Road, West Bridgford, Notts. Secretary: C. G. Taylor. Registered office: Wheeler Gate Chambers, Wheeler Gate, Nottingham.

Woodhead, Stott & Co., Ltd.—Private company. Registered November 14th. Capital, £100. Objects: To carry on the business of wholesale and retail merchants, manufacturers, factors and agents for the sale of, and dealers in, electrical goods of all kinds, including refrigerators, ice-cream making machines, radio apparatus, neon signs and lamps, etc. Subscribers: Jean A. Martin, 58, Richmond Grove, Longsight; and W. Taylor, 389, Oldham Road, Miles Platting. Secretary: Jean A. Martin. Registered office: 44, Brazennose Street, Manchester, 2.

Fields Electrical Utilities, Ltd.—Private company. Registered November 13th. Capital, £1,000. Objects: To carry on the business of merchants of, agents for, and wholesale and retail dealers in, radio, television and electrical apparatus and other sound-producing or sound reproducing and musical instruments, etc. First directors: H. Field, Station Road, Tidworth, Hants, and two others. Registered office: 38, Bridge Street, Andover, Hants.

Ilford Electrical Co. (1945), Ltd.—Private company. Registered November 28th. Capital, £10,000. Objects: To acquire the business of electricians and builders carried on by the Ilford Electrical Co., Ltd., of 4, High Road, Ilford. Permanent directors: J. S. Walford, 31, Longwood Gardens, Ilford, and C. Vince, 6, Derwent Gardens, Ilford. Registered office: 4, High Road, Ilford.

Crossley Electrical, Ltd.—Private company. Registered November 24th. Capital £300. Objects: To carry on the business of electrical and radio engineers and contractors, electricians, etc. J. P. Crossley, Castleton Road, Stamford, Lincs, is the first director. Registered office: "Tor," Casterton Road, Stamford, Lincs.

Elind, Ltd.—Private company. Registered November 3rd. Capital, £200. Objects: To carry on the business of electrical, radio and general engineers, etc. The first director is C. H. Robertson, 16, Albert Mansions, S.W.11.

Mortgages and Charges

Claytelec, Ltd.—Assignment of moneys under contract in respect of war damage repairs, dated November 9th, 1945, to secure all moneys due or to become due from the company to Midland Bank, Ltd.

Increases of Capital

Tucker Electrical Co., Ltd.—The nominal capital has been increased by the addition of £500 in £1 ordinary shares beyond the registered capital of £500.

STOCKS AND SHARES

On December 15th the Government is withdrawing the two present "Tap" issues. It has also decided upon repayment, on April 1st next, of two of the short-dated war stocks. This has had the effect of bringing about substantial rises in British Government funds and other gilt-edged securities, but it failed to influence the prices of ordinary shares, or to check the decline in preference shares, however high their class.

The chairman of the Central Electricity Board has announced the intention to spend £450,000,000, spread over the next five years, in the expansion of the industry. Of this huge sum, one-third is to be spent on generators, and two-thirds on distribution. This would have, in normal times, the effect of bringing investment money into the shares of the manufacturing and equipment companies. But the times are out of joint, and no alterations on this account have taken place in the lists of share prices.

Electricity Supply Shares Fall

The ordinary shares of a score of different companies in the Home electricity supply group show falls that range from 6d. upwards. Declines of 1s. 6d. lowered British Light & Power to 27s. 6d. and Lancashire Light & Power to 32s. 6d. Most of the others in this department have shed 1s. The preference shares are similarly weak. In the Overseas section, Calcutta Electrics at 59s. 6d. and Madras at 39s 6d. have lost 1s. Palestine Electric "A" maintain their strength at 38s. Perak Hydro-Electrics at 16s. are down 1s.

Miscellaneous Movements

Cable & Wireless stocks have fallen into a jog-trot, with the ordinary, 103½, and the preference, 109½, both 2½ points lower on the week. Canadian Marconi keep good at 20s. Oriental Telephones at 57s. 3d. have gone back ⅛ and Marconi Marines are 1s. down at 37s. 3d. Anglo-American preferred put on 1, hardening to 128½. Globe Telegraphs, sympathetically affected by the dullness in Cable & Wireless, are easier at 42s. 6d. for the ordinary and 31s. 6d. for the preference.

British Electric Traction deferred is 20 points down at 1025. Bristol Trams, now 2½, have fallen a florin, and West Riding ordinary, after their recent sharp rise, reacted ⅛, to 53s. 9d. Anglo-Argentine Trams and Brazilian Tractions are lower on the week.

Equipment and Manufacturing

In this section, prices are easier as a whole. Amongst the exceptions are Falk Stadelmanns, ⅛ higher at £2, and Thorn Electrics, 6d. up at 32s. 9d. Dullness is noticeable in English Electrics, 56s., Johnson & Phillips 79s., General Electrics 96s., Mather & Platt 53s. 9d., Associated Electrical, 57s., Crabtree 45s., Crompton Parkinsons 31s. 6d., Enfield Cable 62s., and others. De la Rue ordinary fell 5s. to 103½; Westinghouse Brake at 77s. 6d. are 2s. 6d. lower.

E.M.I. Report

The full accounts of the Electric & Musical Industries group improve the impression made by the preliminary figures published a month ago. The modest increase of £3,700 in the consolidated profit is shown to have materialised in spite of a substantial writing down of patents rights. This account received no allocation a year ago. The cover for the 6 per cent. dividend, plus 2 per cent. bonus, has, therefore, widened, being equivalent now to about 14 per cent. An intriguing reference is made to the acquisition of a group of patents in connection with "a new application of science and engineering" to some branches of the business. The 8 per cent. distribution is the same as was paid in the previous two years. Before that, came two dividends of 6 per cent., following blank years in 1939 and 1940. At the present rate the yield, with the shares standing at 35s., works out to 2¼ per cent.

Radio Shares

The E.M.I. reference to an undisclosed new scientific development is the kind of stimulus which keeps alive the enthusiasm of speculators in radio and kindred shares. Indirectly it helps to maintain share prices at heights which partially discount future profitable developments and expansion. People have radar, and other spectacular wartime radio and electrical discoveries, fresh in their minds. Television as a commercial proposition seems to them to be round the corner. Apart from whatever possibilities may reside in the application to peacetime uses of wartime discoveries, there has accumulated a substantial demand for new wireless sets and domestic electrical appliances. Meanwhile, it is to be expected that speculation will take some fickle turns, as first one company and then another is credited with having some new device up its sleeve which will place it ahead of competition in various fields.

Tube Investments

Tube Investment shares are now quoted ex the dividend and special bonus of 10 per cent., 4s. 6d. in all, which made the dividend 32½ per cent. against the 22½ per cent. that has been paid for each of the past two years. From 1941 to 1943 inclusive, the dividend was 20 per cent., comparing with 23¾ per cent. from 1937 to 1940. It is not unreasonable to look for a return to this dividend. Tube Investments, Ltd., is a holding company, manufacturing, through subsidiaries, every description of tubes, various electrical accessories, fires, cookers, water-heaters, etc. The issued capital is £4,102,000, of which £3,273,651 is in ordinary stock of £1 units. At the present price of 53s. 4d. the yield on the money, taking 22½ per cent. as the basis, is £3 15s. per cent.

India's Foreign Trade

Electrical Imports in 1944-45

THE Government of India has removed the war-time "blackout" on the statistics of the foreign trade of that country, and those relating to the twelve months ended March last are available. The figures showing the values of electrical apparatus and electrical machinery are given in the accompanying table, together with a note of increases or decreases compared with the twelve months ended March, 1944. It will be seen that the only important decreases were in radio apparatus, fans and turbo-generator sets. Imports of other electrical machinery advanced and there were noteworthy increases also in wires, cables and telephone material.

Class	1944-45 Rs. (000)	Inc. or dec. on 1943-44
Fans and parts	193	− 576
From United Kingdom	190	− 576
„ United States	2	+ 1
Wires and cables, rubber insulated	6,104	+ 3,608
From United Kingdom	5,791	+ 3,677
„ United States	312	− 57
Wires and cables, insulations other than rubber	5,363	+ 2,189
From United Kingdom	5,255	+ 2,313
„ United States	92	− 140
Telegraph and telephone wires and cables	294	+ 292
Telegraph and telephone instruments and apparatus	2,339	+ 1,141
From United Kingdom	2,052	+ 961
Gas-filled electric bulbs	2,170	+ 1,064
From United Kingdom	1,935	+ 1,310
„ United States	235	− 246
Vacuum electric bulbs	496	+ 267
From United Kingdom	330	+ 243
„ United States	165	+ 23
Electric bulbs for automobiles	83	+ 35
Electric bulbs for torches	226	+ 94
From United States	222	+ 125
Other electric lamps	106	+ 27
From United Kingdom	20	− 43
„ United States	78	+ 63
Parts and accessories of elec. lamps	72	+ 46
Radio receivers, complete	151	− 593
From United Kingdom	97	− 453
„ United States	20	− 81
Radio valves	218	− 112
From United Kingdom	156	− 100
„ United States	59	− 9
Component parts of radio receivers other than valves	370	− 203
Other radio apparatus	583	+ 235
Batteries for flash lamps	17	+ 13
Other batteries	290	+ 124
Electric carbons	646	− 196
Accumulators	1,381	+ 510
Electric condensers	300	+ 166
Electric bell apparatus	56	+ 13
Electric lighting accessories and fittings	440	+ 144
From United Kingdom	426	+ 148
Electrical instruments other than telegraph and telephone:—		
Meters	492	+ 130
From United Kingdom	479	+ 134
„ Switzerland	1	− 5
Ditto, other	406	+ 99
From United Kingdom	343	+ 138
Electro-medical apparatus	582	+ 307
From United Kingdom	169	+ 88
„ United States	407	+ 213
Switchboards, other than telegraph and telephone	275	+ 103
From United Kingdom	274	+ 103
Electrical porcelain ware—		
From United Kingdom	178	+ 130
Electrical goods and apparatus, not enumerated	3,203	+ 1,464
From United Kingdom	2,295	+ 884
„ United States	860	+ 575
Control and switchgear	7,771	+ 2,243
Generators, alternators & dynamos	3,059	+ 115
Motors	6,715	+ 2,492
Transformers	5,364	+ 2,533
Turbo-generator sets	1,041	− 883
Other electrical machinery	6,209	+ 1,268
Total of electrical machinery	30,159	+ 7,767
From United Kingdom	26,612	+ 6,889
„ United States	3,131	+ 704

Indian Market Survey

HITHERTO suppliers to export markets have relied to a great extent upon official reports when studying conditions in those markets. These are often excellent general reviews but have to be "all things to all men" and are consequently inadequate to those concerned with a particular branch of export trade. In an endeavour to remedy this, so far as mechanical engineering is concerned, the Export Committee of the British Engineers' Association has produced its own guide to the Indian market. This contains a great deal of up-to-date "background" information on the structure of India, physical features and resources, the political situation and recent history, leading up to a survey of Indian economics and trade, with particular reference to machinery. Related to this is a section on the industrialisation of the various States and Provinces. It is stressed that progress in large-scale industrialisation can reasonably be expected to be rapid in the next decade.

Though there is a strong tendency towards the "Indianisation" of industry Indians appear to realise that they cannot undertake industrial expansion without capital, equipment and technical assistance which they hope to obtain from the United Kingdom or the United States. This leads to the consideration of the advantages accruing from an equitable partnership between Indian and British industrialists, one aspect of this being the establishment, by the latter of Indian factories. Another is the prospect under such an arrangement of increased Indian imports from this country for a considerable time.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Electric Kettle

An electric kettle of pleasing design is just being put on the market by L. J. CROWSON & CO. LTD., 41, Loudoun Road, London, N.W.8. The body, of four pints capacity, is exceptionally strong, being pressed and spun in one piece from 14 s.w.g. aluminium, and the

The Crowson kettle

spout, of cast aluminium, is welded into position. The highly polished finish gives a very attractive appearance. The 1,500-W element fitted as standard, is of the immersion type, has an automatic cut-out, and is guaranteed for one year. The kettle is supplied complete with adaptor plug and two yards of flex.

Battery Vehicles

Battery electric vehicles are to be constructed by NORTHERN COACHBUILDERS, LTD., Claremont Road, Newcastle-on-Tyne, 2, in three sizes—10-15-cwt., 18-22-cwt. and 25-30-cwt. With streamlined bodies on all welded chassis, the

N.C.B. 10-15-cwt. battery vehicle

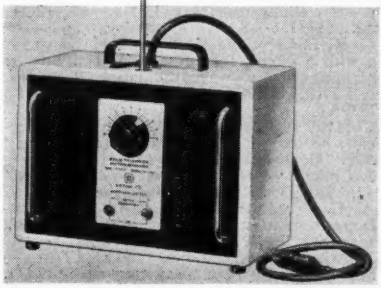
vehicles will be provided with the B.T.H. control system which gives economical two-speed operation and combines the advantages of parallel-series battery control with reliability, low maintenance and lightness of operation associated with foot-operated contactor control. The motor is series wound and the "Exide" traction-type batteries are of capacities suitable for the range and pay-load required. The rear axle is of the overhead worm type, of semi-floating design, specially designed for silent running under all conditions. Special bodies can be supplied to suit any particular trade.

Television Pattern Generator

An inexpensive pattern generator, specially designed to enable service men to check the adjustments of television receivers when vision signals are not available, is announced by E. K. COLE, LTD., Southend-on-Sea, Essex. The dimensions of the type TSE/1 instrument are 12·5 by 9·5 by 8 inches and its chassis is enclosed in a metal case fitted with a carrying handle, rubber feet and ventilating louvres at the back. It is AC mains energised through a tapped transformer, the input load approximating to 30 W. A double pole toggle switch and a 0·3 A 6·3 V ruby pilot lamp are provided.

Television pattern generator for checking sound - vision receivers

The valve oscillator has a frequency range of 40 to 50 Mc/s, adjustable by a control knob with a



double calibration dial to facilitate testing both the sound and vision circuits. In the latter case the pattern imposed on the receiver screen consists of two black vertical bars and one horizontal grey bar on a white background. The radio-frequency output of 2 mV from the test generator is passed to the aerial socket of the television receiver being checked by a cable of 80 Ω impedance terminating in an "Ekco" plug with three built-in resistances forming a ten-to-one attenuator. Disconnection of this interconnecting cable and substitution therefor of a short metal rod plugged into the top of the tester provides a weak (but sufficient) radiator for checking the television receiving aerial.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

AKT.-GES. Brown, Boveri & Cie.—"Method of regulating a gas turbine which is driven by the exhaust gases of an internal-combustion engine." 19115/43. September 2nd, 1943. (573252.) "Arrangement for displacing the ignition point of grid-controlled electric discharge vessels." 8784/43. May 23rd, 1942. (573345.)

Allmänna Svenska Elektriska Aktiebolaget.—"High reactance transformers." 9727/43. June 22nd, 1942. (573273.)

Automatic Telephone & Electric Co., Ltd.—"Repeaters for telephone or like signalling systems." 20659/43. March 5th, 1943. (573354.)

Belling & Lee, Ltd., and C. W. Heath.—"Electrical cartridge fuses." 19789. November 26th, 1943. (573280.)

Bristol Aeroplane Co., Ltd., R. Ponting, Heenan & Froude, Ltd., and G. H. Walker.—"Electric eddy current driving mechanisms." 4859. April 13th, 1942. (573239.)

H. Butler, Ltd., and H. Butler.—"Electrical and other measuring instruments." 17874. October 29th, 1943. (573320.)

R. M. Chamney.—"Electrical cable construction." 21887. December 31st, 1943. (573261.)

E. J. Clarke and Murex Welding Processes, Ltd.—"Welding rods." 6837-8-9. May 20th, 1942. (573336-7-8.)

G. R. E. Cleveland.—"Thermionic valve for use with a circuit for amplifying, rectifying, or generating electric wave oscillations." 14318. July 27th, 1944. (Addition to 571678.) (573395.)

Coldair, Ltd., and W. F. Comben.—"Electrically-heated smoothing irons and the like." 16502. October 8th, 1943. (573316.)

J. Collard.—"High-frequency transformers." 7042. June 3rd, 1941. (573365.)

A. C. Cossor, Ltd., and A. G. Mitchell.—"Deposition of materials by settling." 5880. March 30th, 1944. (573289.)

Darwins, Ltd., A. Linley and A. Torry.—"Manufacture of permanent magnets." 12471. September 26th, 1941. (573238.)

Edison Swan Electric Co., Ltd., and P. E. Cane.—"Pool type cathode metal vapour arc rectifiers." 19774. November 26th, 1943. (573328.)

Electric Resistance Furnace Co., Ltd., and A. J. Cook.—"Heat treatment furnaces." 2764. February 15th, 1944. (573287.)

Farnsworth Television & Radio Corporation.—"Keystone correction circuit for television apparatus." 7399/43. April 1st, 1942. (573272.) "Keystone correction circuit for television apparatus." 12749/43. April 30th, 1942. (573274.)

Foster Transformers & Switchgear, Ltd., and R. I. Bagnall.—"Electric transformers." Cognate applications 21909/43 and 21111/44. December 31st, 1943. (573283.)

B. M. Hadfield.—"Thermionic valve circuits." 18359. November 5th, 1943. (573348.)

T. G. P. Healey.—"Electric storage battery testers." 6568. April 7th, 1944. (573267.)

R. G. McEwan and C. Orr.—"Electric indicator apparatus for seating accommodation in double-decked passenger vehicles." 20018. November 30th, 1943. (573255.)

F. G. Mitchell.—"Cooling towers." 18419. November 5th, 1943. (573321.)

W. Moiseiwitsch.—"Electrical tea or coffee brewing appliances." 6743. April 12th, 1944. (573268.)

W. E. Radley (Eitel-McCullough, Inc.).—"Multiple section electronic tube and method of making it." 12503. August 3rd, 1943. (573313.)

Scophony, Ltd., and S. H. M. Dodington.—"Electric oscillator circuits." 14344. September 19th, 1940. (573269.)

Soc. Rateau.—"Devices for starting gas turbine plants." 1714/42. March 1st, 1941. (573271.)

Sodeco Soc. des Compteurs de Genève.—"Prepayment telephone apparatus." 19805/43. November 18th, 1942. (573329.)

Svenska Turbinfabriks Aktiebolaget Ljungström, O. A. Wiberg and K. R. Sjoblom.—"Device for measuring steam and gas temperatures in turbines or the like." 5437. March 23rd, 1944. (573361.)

Thorn Electrical Industries, Ltd., and J. W. Strange.—"Manufacture of mercury discharge tubes." Cognate applications 19940/43 and 19400/44. November 29th, 1943. (573253.)

The Heat Pump

PUBLISHED information on the Heat Pump for Space Heating has been summarised in a 16-page report (Y/T7), with 12 figures and six tables, which has been prepared by D. V. Onslow for the British Electrical and Allied Industries Research Association (4s. net).

The theory of the reversed Carnot engine in relation to refrigeration is discussed with particular reference to efficiency, sources of heat and operating costs. Data are given for installations in the United States (where thirty or forty are said to be in operation) and in Switzerland. Reference is also made to the unit recently put into commission by Norwich Corporation.

It is concluded that while the heat pump ensures a saving of high-grade energy equivalent to many times the amount expended, full economic benefit in Great Britain requires its association with summer air-conditioning, as in cinemas, theatres and crowded work places. In residential premises its use is expected at present to be limited. It is considered desirable to design a heat pump for average heating requirements, using additional fuel on extremely cold days.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Ashton-under-Lyne.—December 17th. Town Council. Electrical wiring of fifty houses, Reyner Lane. Particulars from the chief engineer, Electricity Works, Wellington Road.

Australia.—March 7th, 1946. Sydney County Council. Coal-handling plant for Pyrmont "B" (Spec. 72).—*Tenders* (Melbourne).

Eire.—February 28th. Electricity Supply Board. Transformers and switchgear for Cathaleen's Fall and Cliff stations on the River Erne. (See this issue.)

Inverness.—December 12th. Electricity Department. Switchgear kiosk; 6·6 kV switchgear; 250-kVA kiosk substation; and 500-kVA distribution transformer. (See this issue.)

Maesteg.—January 1st. Electricity Department. L.v. mains, services and public lighting. (See this issue.)

Manchester.—December 31st. Electricity Committee. 6·6-kV switchgear and one 20-ton road weighbridge and frame. (See this issue.)

Oldham.—December 14th. Electricity Department. E.h.v. cable, cast-iron frames and covers. (November 30th.)

Sheffield.—December 12th. Town Council. Tramcar traction motors. Particulars from the general manager, Transport Department, Division Street.

Tredegar.—December 29th. Urban District Council. Two 250-kVA and one 500-kVA transformers. (See this issue.)

West Riding.—December 10th. Public Health and Welfare Committee. Electrical work, Sanygate House, Wath-upon-Dearne, County Welfare Institution, Tadcaster. Particulars from the West Riding county architect, County Hall, Wakefield.

Wrexham.—December 18th. Rural District Council. Wiring of 106 houses. Particulars from Mr. D. E. Edwards, engineer, Imperial Buildings.

Orders Placed

Bedford.—Electricity Committee. Recommended. Kiosk substation (£650).—Johnson & Phillips.

Birmingham.—Electricity Committee. Accepted from July 17th to November 16th. Meters.—Ferranti; Chamberlain & Hookham. 100 circuit-breakers.—George Ellison.

Glasgow.—Transport Committee. Accepted. Dry cells.—Siemens Bros. Points controllers.—Forest City Electric Co. Asbestos-covered wire.—E. & E. Kaye.

Poplar.—Electricity Committee. Accepted. Power station battery repairs (£304).—Hart Accumulator Co. Electric arc welder (£63).—Eutalloy & Welding Processes. Six distribution transformers (£2,727).—Johnson & Phillips. 250 25-A prepayment meters (£1,016).—Ferranti. 250 25-A prepayment load rate meters (£1,241).—Metro-Vick. 58 concrete lamp columns (£408).—Concrete Utilities.

Rochdale.—Town Council. Accepted. Dictograph inter-conversing system, town clerk's and borough surveyor's departments.—Dictograph Telephones, Ltd.

Seaham (Durham).—Urban District Council. Accepted. Circuit-breaker (£107).—A. Reyrolle & Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alnwick.—Houses (34), Shilbottle; R.D.C. surveyor. Conversion of Bondgate Hall to social club; R. Rothwell, R.D.C. clerk.

Battersea.—Houses (34), Sheepcote Lane; borough engineer.

Bedford.—Community centre, housing estate; borough engineer.

Bexhill.—Development at Church Farm estate; Wrestwood Estates, Ltd.

Birmingham.—Schools, Cherry Orchard Road (£26,465) and Calshot Road (£27,100) and conversion and reconditioning houses (£24,933); city engineer.

Bo'ness.—Housing scheme (electrical work); town clerk.

Brixton.—Rebuilding houses, Tulse Hill estate (£12,759); Demolition & Construction Co., Ltd.

Carlisle.—Clinic for E.C. (£420); city architect, 18, Fisher Street.

Caterham.—Houses, Tillingdown Hill (24), and Crewes Lane (21); U.D.C. surveyor.

Chelsea.—Block of flats (£109,000), Pond Place; borough engineer.

Congleton.—Permanent houses (30), Bromley Farm estate, for T.C.; borough engineer, Town Hall.

Crook and Willington.—Houses (52), for U.D.C.; Page, Son & Hill, architects, 75, King Street, South Shields.

Falkirk.—Baths, etc., at works for Carron Co; manager.

Felling (Durham).—Houses (48), Felling House and Holly Hill estates for the U.D.C.; housing architect.

Works additions (£40,000); International Paint & Composition Co., Ltd.

Folkestone.—Bungalows (124), Folkestone and Cheriton; E. L. Allman, borough engineer, Municipal Offices.

Glasgow.—Sports stadium, skating rink, etc., for Corporation; city architect.

Houses (100), Balornock estate, and 500 Weir houses on other estates; Scottish Special Housing Association, Ltd.

Garage, Lister Street and Kennedy Street; Stuart Tough & Alexander, architects.

Guildford.—Offices, Commercial Road; Friary, Holroyd & Healy's Breweries, Ltd.

Houses (70), Bellfields estate (£82,377); W. H. Gaze & Sons, Ltd.

Hackney.—Houses and flats, Shacklewell Road (£137,650); F. Gibberd, architect.

Hebburn-on-Tyne.—Senior school for managers; Rev. E. Whitty, P.P., St. Aloysius' Church.

Herne Bay.—Houses (16), Blean View estate; U.D.C. surveyor.

Horncastle.—Clothing factory, Bridge Street; Grahame & Merritt, Ltd., 40, Granby Street, Leicester.

Houghton-le-Spring.—Houses (68), direct labour; surveyor, U.D.C. offices.

Huddersfield.—School, Commercial Street; Priest-in-Charge, St. Joseph's Presbytery, 47, Commercial Street.

Isle of Wight.—Secondary schools at Sandown and Cowes; county architect.

Ladybank.—Houses (14), for Town Council; L. A. Roland, architect and surveyor, 47, High Street, Leven, Fife.

Lanchester.—Houses (22); surveyor, U.D.C. offices.

Lochgelly (Fife).—Houses (30), electrical work; town clerk.

London.—Housing schemes in Peckham, Shoreditch and Bethnal Green (£640,500) and rebuilding damaged houses on various estates (£130,000); L.C.C. architect.

Mansfield.—Factory, Chesterfield Road; C. H. Hill & Sons, Ltd.

Middlesbrough.—Cinema, Acklam Road South; W. E. Haslock, architect, 143, Albert Road.

Electrical installation, General Hospital, for T.C.; borough engineer.

Morecambe.—Dairy, Fairfield Road; Morecambe Bay Creameries, Ltd.

North Riding.—Secondary schools, Redcar and Bedale; county architect, County Hall, Northallerton.

Northumberland.—School canteens, for C.C., Ellington (Carse & Son, Amble, builders), Elsdon (W. Brown & Son, builders, Thropton), and Horncliffe (T. Gardiner, builder, Berwick).

Penrith.—Houses (80), Scaw estate; U.D.C. surveyor.

Pocklington.—Houses (24), Stamford Bridge, for the R.D.C.; W. A. Kellett, architect, 8, Lendal, York.

Portland.—Extensions, concrete works; Bath & Portland Stone Firms.

St. Marylebone.—Blocks of flats, Princess Street and Church Street; Stanley Hall & Easton & Robertson.

Shildon (Co. Durham).—Houses (50), for U.D.C.; Kitching & Co., architects, 40, Albert Road, Middlesbrough.

Southgate.—Flats (36), North Circular Road; F. Ferrier Tomlin, 195, High Road, Wood Green.

Stornoway.—Houses (162), Lewis; county clerk, Ross County Council.

Thurso.—Houses (18), for Town Council; Sinclair Macdonald & Son, architects, 18, Princes Street.

Wisbech.—Houses (39), Lerowe Road; J. E. & L. F. Dagless, Alexandra Road.

Houses (80), various parishes; R.D.C. surveyor.

York.—Rebuilding ward at Fairfield sanatorium (£6,000); houses (108), Various sites; temporary school (£4,895), Ashfield site; city architect.

Rebuilding workshops, 67, Micklegate; Dodsworths, Ltd.

Extensions, maternity hospital; city architect.

Housecraft Scholarships

AT a meeting of the Electrical Association for Women, to inaugurate the Caroline Haslett Trust for scholarships and travelling exhibitions in electrical housecraft last week, Mrs. M. B. Jackson announced that the electrical industry had guaranteed £2,000 to the fund and that in addition the Association's branches had raised £1,270 to date. Mrs. Jackson explained that the Trust was launched both as a contribution towards helping in the transition from war to peace and also as a means of honouring the work of the director who founded the E.A.W. twenty-one years ago with a strong belief in the future place of women in Britain's electrification and its effect on women's status. Special thanks were due to Sir Andrew Duncan for his personal interest and encouragement, and to the leading electrical organisations which were the financial sponsors of the scheme.

Miss Ellen Wilkinson, Minister of Education, who was one of the first vice-presidents of the E.A.W., said that this was the first time a scholarship had been awarded in the name of a woman and for women in the electrical world. In electrical housecraft women could find a means of great benefit to their homes and a career both advantageous to themselves and the nation's well-being. With a cheap and plentiful domestic service never likely to be available again, electricity offered women the only means of eliminating household drudgery and securing increased leisure.

Need for Trained Women

Mr. Harold Hobson, chairman of the Central Electricity Board, who has taken a leading interest in the establishment of the Trust, said that during the next five years the electricity supply industry was to embark on a £450,000,000 programme of expansion, including £150,000,000 for generating plant and double that amount for distribution. This would result in an increase in electricity output of between eight and ten thousand million kWh a year, of which probably more than a half would be used for domestic purposes. To meet this great expansion ahead there would be need for increasing numbers of women trained in electrical matters, both in connection with the production of the equipment necessary to take full advantage of electrical services and also in seeing that the apparatus was properly used and maintained. The ideas and information gained through the travelling scholarships would enrich the domestic and industrial life of the country.

Miss Caroline Haslett, in expressing her appreciation of the tribute paid to her, said that the Association was proud to receive whole-hearted recognition of its achievements from all sections of the electrical industry and it looked forward to a great expansion in women's careers in the electrical world.